SITE INVESTIGATION REPORT

Hess Corporation - Former Port Reading Complex
750 Cliff Road
Port Reading (Woodbridge Township), Middlesex County, New Jersey
ISRA Case No. E20130449
NJDEP PI No. 006148
EPA ID No. NJD045445483

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Appendix 2 – Groundwater Monitoring Reports
Appendix 3 – Order of Magnitude Analyses
Appendix 4 – Data Usability Evaluations (DUEs)
Appendix 5 – EPH Calculator Spreadsheets
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SITE INVESTIGATION REPORT
Hess Corporation - Former Port Reading Complex (HC-PR)750 Cliff Road
Port Reading (Woodbridge Township), Middlesex County, New Jersey

1.0 INTRODUCTION

Earth Systems has prepared this Industrial Site Recovery Act (ISRA) Site Investigation (SI) Report for the Hess Corporation - Former Port Reading Complex located at 750 Cliff Road, Port Reading, Middlesex County, New Jersey. **Figure 1** illustrates the site location on a United States Geological Survey 7.5 Minute Series Arthur Kill New Jersey/ New York Quadrangle and **Figure 2** shows a scaled site plan.

On October 9, 2013, Hess executed an agreement to sell the Port Reading Complex. The property transfer was completed on December 11, 2013. The Complex (excluding Block 664.01 Lots 1.01 and 1.02) is currently owned and operated by Buckeye Partners, L.P. (Buckeye) of Breinigsville, Pennsylvania. Hess remains responsible for the investigation and remediation of the current Solid Waste Management Units (SWMU), Areas of Environmental Concern (AOC), Historic Spills (HS), and Remediation Management Units (RMU). In addition, Hess decommissioned and demolished the refinery process units in 2014 through early 2015. It is Hess' understanding that Buckeye plans to operate the Complex solely as a bulk petroleum terminal.

In accordance with New Jersey ISRA (N.J.A.C 7:26B) requirements, Hess submitted a General Information Notice (GIN) to the New Jersey Department of Environmental Protection (NJDEP) on October 14, 2013 and ISRA Case No. E20130449 was assigned to the Site.

Earth Systems completed a Preliminary Assessment Report (PAR) of the property to identify potential areas of environmental concern (AOCs) associated with past and current site operations, including the following components:

- A review of reasonably available federal, state, and local records through electronic database searches and document requests;
- Multiple site inspections to visually identify AOCs relating to present and past site operations;
- A search for and review of Sanborn Fire Insurance maps, the Industrial Directory Report, aerial photographs, historical city directory information, historical topographic maps, and historical deed information, if available;
- Interviews with knowledgeable former and current site personnel; and
- Detailed report generation.

A total of 117 AOCs were identified during the PA. Of that total, Earth Systems concluded that 63 of the AOCs required further investigation. The PAR was submitted to the NJDEP on October 9, 2015. A request for a 30-day extension to the deadline for the SIR was submitted to the NJDEP and subsequently granted.

Site Investigation activities were completed between June 2014 and September 2015. SI activities were conducted using hand-auger/air knife equipment for surface samples and/or a GeoProbe® direct-push earth drill unit to advance soil borings and temporary well points in an effort to investigate potential impacts associated with the AOCs identified during the PA activities.

The findings of the soil and groundwater investigation are summarized in this report. All SI activities were performed to satisfy NJDEP requirements in accordance with N.J.A.C. 7:26E, *Technical Requirements for Site Remediation* (TRSR); N.J.A.C 7:26C, *Administrative Requirements for the Remediation of Contaminated Sites* (ARRCS); N.J.S.A. 58:10C-1 et seq., *Site Remediation Reform Act* (SRRA); *Field Sampling Procedures Manual (FSPM),* and the associated NJDEP Guidance Documents.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Property Description, Site Vicinity, and General Characteristics

A description of the subject property, including current and historical uses, is provided below. Also provided is a description of the surrounding properties and their usage.

Facility Name: Hess Corporation - Former Port Reading Complex
(AKA Amerada Hess Corporation; current Buckeye Port Reading Terminal)

Physical Address: 750 Cliff Road
Port Reading (Woodbridge Township), Middlesex County, New Jersey
Block 756, Lot 3
Block 756.01, Lot 1.02, 2, & 3
Block 756.02, Lots 1 & 8
Block 757, Lot 1
Block 760, Lot 6
Block 760.01, Lots 2 & 3
Block 760.02, Lots 1, 2, & 3
Block 1095.01, Lot 6
Block 664.01, Lots 1.01 & 1.02

Current Property Owner: Buckeye Partners, L.P
Address: 5 Tek Park, 9999 Hamilton Boulevard
Breinigsville, Pennsylvania 18031

According to Woodbridge Township zoning maps, the 223 acre Site is located within an M-2 zone (heavy industrial) and is currently comprised of a petroleum storage facility, a recently demolished oil refinery (demolished in 2014/2015), and approximately 46-acres of vacant land. A site plan for the Former Port Reading Complex is presented as **Figure 2**.

2.2 Current Site Operations

The former refining portion of the facility has been decommissioned and is primarily vacant. The bulk petroleum storage portion of the facility continues to be utilized by Buckeye for the storage and distribution of petroleum products.

2.3 Historic Use of the Property

Prior to 1958, the property was tidal marsh along the Arthur Kill with the upland area to the northwest having uncultivated fields and several buildings. The Site had been owned and operated as a petroleum refinery and bulk petroleum storage terminal by the Hess Corporation (Hess) since 1958, with expansions to the refinery occurring between 1958 and 1970. In 1974, refining operations were suspended and the facility operated only as a bulk storage and distribution terminal until 1985. In April 1985, following a retrofit, the facility resumed refining operations, producing gasoline, fuel oil, and other hydrocarbon products (e.g. methane, ethane, and liquid petroleum gas). Refining operations ceased at the end of February 2013 and the demolition of the refining portion of the facility was completed in early 2015. The petroleum storage facility will continue to operate under Buckeye Partners.

2.4 Current Uses of the Adjoining Properties

The Site is located east of Cliff Road, southeast of Port Reading Avenue, and southwest of the Conrail Port Reading Rail yard and former coal docks. Immediately east/southeast of the Site is the Arthur Kill shipping channel and to the southwest is the Public Service Electric and Gas (PSEG) Sewaren Generating facility. A mixture of industrial and commercial properties is located to the west, two residential properties are located to the northwest, and an industrial property is located to the south

3.0 PHYSICAL SETTING

3.1 Site Soils

According to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey, the majority of the site (96%) is situated within the UR (Urban Land) soil unit. UR soils consist of disturbed and natural soil material covered by pavement, concrete, buildings, and other structures. A small portion (3%) located at the southeast property boundary is classified as Pssa (Psamments, 0 to 3 percent slopes). This unit consists of well drained sandy deposits.

According to the NJDEP GIS NJ-GeoWeb Historic Fill data layer, the majority of the property is mapped as containing historic fill material. The northwestern portion of the site is not mapped as containing historic fill material.

3.2 Geology and Hydrogeology

According to the New Jersey Geological Survey (Perth Amboy and Arthur Kill Quadrangles - Stanford, 1999), the regional surficial geology of the majority of the site is mainly comprised of Artificial Fill overlaying Estuarine and Salt-Marshland deposits, while the surficial geology of the northwestern portion of the site is comprised of Rahway Till. The estuarine and salt-marshland materials are native materials comprised of peat, and organic clay and silt, brown to dark grey, with some sand and shells. The deposits can be as much as 100 feet thick and contain abundant organic matter. The soil boring logs confirm silty sand and clay down to the maximum boring depth of approximately 31 feet. Rahway Till is comprised of reddish-brown clayey, silty sand with some pebbles and cobbles and generally more than 10 feet in thickness.

The Bedrock Geology, as identified by the NJ GeoWeb map for the Site, is underlain by the Raritan, Passaic and Lockatong Formations. The Lockatong and Passaic Formations are of the Piedmont Physiographic Province of Triassic and Jurassic Age. These rock formations are overlain by the younger Raritan Formation which is the lowest unit of the Coastal Plain Physiographic Province of Cretaceous Age. The majority of the Site is underlain by the Raritan Formation, described as clayey silt overlying quartz sand. The most north/northeast portions of the Site, located near the intersection of Cliff Road and the Port Reading Railroad, are underlain by the Passaic and Lockatong Formations. The Passaic and Lockatong formations are described as siltstone and shale, and dolomitic/silty argillite, mudstone, sandstone, and siltstone, respectively.

According to the NJ GeoWeb GIS system, the Site hydrology consists of the Potomac-Raritan-Magothy, Brunswick, and Lockatong aquifers. The majority of the Site is underlain by the Potomac-Raritan Magothy aquifer. The most north/northeast portions of the Site, located near the intersection of Cliff Road and the Port Reading Railroad, are underlain by the Brunswick and Lockatong aquifers. The Potomac-Raritan-Magothy Aquifer is described as interbedded sand, gravel, silt, and clay. Water within the aquifer is fresh, moderately hard, with elevated iron and manganese, and increased salinity near the coastline and Raritan Bay. The aquifer has a medium yield of greater than 500 gallons per minute (gpm). The Brunswick Aquifer is described as sandstone, siltstone, and shale of the Passaic, Towaco, Feltville, and Boonton formations. The Lockatong Formation is described as silty argillite, mudstone and fine-grained sandstone and siltstone. Water within the Brunswick and Lockatong formations is normally fresh, slightly alkaline, non-corrosive, and hard (calcium-bicarbonate type waters) and have expected medium yields of up to 250 gpm and 100 gpm, respectively.

The shallow unconfined water table at the Former Port Reading facility was encountered between 1.5 and 11 feet below ground surface, dependent on the surface elevation. The average hydraulic gradient is approximately 0.001 feet per foot (ft/ft). Groundwater flow is predominately southeasterly in the northwest portion of the facility and east-southeasterly in the central portion of the facility. Groundwater at the site is affected by tidal influences, especially as noted in those monitoring wells in close proximity to the Arthur Kill.

3.3 Topography and Surface Water

Topography of the Site and surrounding area is generally flat with a very gradual slope downward toward the Arthur Kill. The total difference in topographic relief on the developed portion of the site is less than 5 feet. Surveyed ground surface elevations indicated that the developed portion of the property, which has an approximate total area of 223 acres, ranges in elevation from 5 to 10 feet above MSL referenced to North American Vertical Datum of 1988 (NAVD88).

A man-made drainage ditch and a detention basin are located onsite to control surface water prior to its flow to the Arthur Kill. The only water that enters the North Drainage Ditch (**Figure 2)** is stormwater that sheet flows outside of the containment on the north side of the property, as well as water from the No. 1 Landfarm leachate treatment system. Water that enters the Smith Creek is from the Urban Sewer, which enters the site at the north corner of the property and is utilized to collect water from the parking lots that are along the west side of Cliff Road. Stormwater from all of the containment areas, the loading racks, and the former process areas, are discharged through permitted outfalls.

A review of the Flood Insurance Rate Maps (Middlesex County, New Jersey), published by the Federal Emergency Management Agency (FEMA), indicate that areas of the subject property are located within the 100-year flood zone (southwest including the detention basin and northeast areas), the 500-year flood zone (northeast tank farm area, south tank farm, equipment storage areas adjacent to the Arthur Kill and bulkheads/ docks), and non-flood zone areas (northwest portions adjacent to Cliff Road).

As illustrated on **Figure 1**, the closest surface water body is the Arthur Kill shipping Channel located along the southeastern property boundary. The Arthur Kill is classified FW2-NT/SE-1. According to N.J.A.C. 7:9B Surface Water Quality Standards, FW2-NT/SE-1 indicates a waterway where a salt water/fresh water interface may exist. The interface is determined by salinity testing with FW2-NT in the fresh portion (less than or equal to 3.5 parts per thousand) and SE1 in the saline portion. According to N.J.A.C. 7:9B, FW2-NT (non-trout) waters may be used for maintenance, migration and propagation of natural biota; recreation; industrial and agricultural supply; public water supply (after filtration) and disinfection; and other reasonable uses. Waters classified as SE1 may be used for shellfish harvesting; maintenance, migration, and propagation of natural biota; recreation; and other reasonable uses.

According to the NJDEP GIS NJ-GeoWeb mapping, there are no mapped wetlands on the subject site. A strip of land classified as saline marsh wetlands is identified approximately 125 feet northeast of the site. In addition, phragmites-dominant interior wetlands are located approximately 300 feet north of the site and a combination of phragmites-dominant interior wetlands and herbaceous wetlands is located approximately 1,000 feet southwest of the site.

4.0 METHODOLOGY

Soil and groundwater sampling was been on-going on the Hess Corporation Former Port Reading Complex. The sampling techniques implemented by Earth Systems are detailed below. All efforts were made to eliminate sample contamination and maximize the reliability of the analytical results. These efforts include proper use of sampling equipment, the use of a quality assurance program to maximize the accuracy and precision of the analytical results, and use of Chain-of-Custody procedures to track samples from source to analysis and minimize the opportunity for tampering. The following subsections provide details pertaining to the sampling methodology and quality assurance evaluation conducted in the investigations.

4.1 Sampling Methods

All sample collection activities were conducted so as to obtain reliable information regarding subsurface conditions and representative samples for analysis. Earth Systems professionals licensed in subsurface evaluation by the NJDEP implemented all sampling at the property.

Sample bottles were provided by the laboratory and remained sealed until placed beneath the sampling tool for sample collection. After a sufficient amount of sample was collected, the bottle was sealed with a screw cap. Immediately following its collection, the sample was placed in a cooler and kept at 4^{o} C until its arrival at the laboratory. These procedures were used at each sample location.

4.2 Soil Sampling

Soil sampling activities were conducted using hand-auger/air knife equipment and/or a GeoProbe® direct-push earth drill unit to advance soil borings. The soil sample acquisition was performed with the samples collected in dedicated laboratory-provided bottles by direct grab. The samples were submitted to Accutest for Total Petroleum Hydrocarbons (TPHC), Extractable Petroleum Hydrocarbons (EPH), Volatile Organic Compounds (VO), Base Neutral Semi-volatile Compounds (BN), Total Analytical List Metals (Metals), Pesticides, PCBs and general chemistry parameters. The soil analytical results were compared to the NJDEP's *Soil Remediation Standards* (SRS), N.J.A.C. 7:26D, to determine whether any contaminants exceeded applicable NJDEP Residential and /or Non-Residential Direct Contact Soil Remediation Standards (RDCSRS and NRDCSRS).

4.3 Groundwater Sampling

Sampling personnel conducted all fieldwork in accordance with N.J.A.C. 7:26E and the Department's *Field Sampling Procedures Manual,* August 2005 revision (FSPM). The groundwater samples were collected for VO, BN, and/or Metals analyses, which was performed by Accutest. Field and trip blanks were collected for quality assurance purposes. The ground water analytical results were compared with the NJDEP Class II-A Ground Water Quality Standards (GWQS) (July 27, 2011 revision) to determine whether any detected compounds exceeded applicable NJDEP GWQS.

Prior to sampling, all monitoring wells were gauged to determine the depth to water. For wells with sufficient recharge, three well volumes were purged to acquire the samples. For wells with minimal recharge, a pneumatic power bladder pump was used for purging at a slow rate following low flow techniques cited in Section 6.9.2.2 of the FSPM. The general chemistry of the purged ground water was monitored to assess the quality of the recovered water. When stability was achieved with the groundwater general parameters, the formation water was deemed at equilibrium and a ground water sample was collected.

The laboratory reports for all sampling dates are provided as attachments. The electronic deliverables for the sampling data are also provided herein.

4.4 Laboratory Analytical Data QA/QC Review

Review of the laboratory analytical data packages indicates that the submitted data are reliable. Specifically, according to all reports, samples were received intact and at the required preservation temperature, sample holding times were met, and calibrations for each method were acceptable.

4.5 Data Reliability

All laboratory samples were collected, maintained, and transported in accordance with standard quality assurance/quality control (QA/QC) protocol. All samples were analyzed by Accutest Laboratories, a NJDEP certified laboratory (NJDEP Certification #12129), located in Dayton, New Jersey. All laboratory analytical reports are provided in **Appendix 6**. The Electronic Data Deliverables (EDDs) have been submitted electronically as required by the NJDEP. Copies of the email transmissions are included in **Appendix 7**.

A Data Usability Evaluation (DUE) was performed for each non-conformance and is provided as **Appendix 4.** Due to the large amount of samples collected and data generated as part of the Site Investigation, DUEs for each of the laboratory data sets are included in **Appendix 4**.

5.0 SITE INVESTIGATION – HISTORIC AREAS OF CONCERN

Historic AOCs designate impacted areas of the Site that have required continued investigation, some of which were initiated in the 1980s. The following sections present summaries of these AOC soil and groundwater investigations and any other pertinent activities. The Historic AOCs are identified on **Figure 5** and include the following:

- Historical AOC-1 – First Tankfield
- Historical AOC-2 – South Landfarm
- Historical AOC-3 – No. 1 Landfarm
- Historical AOC-4 – Dredge Spoils
- Historical AOC-5 – Aeration Basins
- Historical AOC-6 – HSWA USTs
- Historical AOC-7 – Central Colonial Pipeline
- Historical AOC-8 – Waste Container Storage Area
- Historical AOC-9 – Alkylation Unit (Sewer Line)
- Historical AOC-10 – Truck Loading Rack
- Historical AOC-11a – Administration Building
- Historical AOC-11b – Former Training Center
- Historical AOC-12 – Smith Creek and Detention Basin
- Historical AOC-13 – Former Oil Water Lagoons

5.1 Historic AOC-1 North Landfarm

The North Landfarm (NLF) is a land treatment system located along the central northeast property boundary as shown in **Figure 5**, encompassing approximately one-third of an acre. It is constructed of earth berm walls and a silt and clay bottom liner comprised of dredged fill material and native marsh soils. The NLF was permitted under New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Groundwater Permit No. NJ0028878 to treat Resource Conservation Recovery Act (RCRA) hazardous waste - American Petroleum Institute (API) separator sludge (K051) and leaded tank bottoms (K052). The unit was constructed in 1974 and operated from 1975 to October 24, 1988, receiving Interim Status in 1980. Approximately 21 tons of hazardous waste were applied to the treatment system.

The NLF was identified as a Solid Waste Management Unit (SWMU) during a 1986 RCRA Facility Assessment (RFA) conducted by the United States Environmental Protection Agency (USEPA) under the RCRA Corrective Action Program. On April 18, 1988, investigative and remedial requirements for the NLF (and other site SWMUs) were incorporated into the facility's Hazardous and Solid Waste Amendment (HSWA) Permit No. NJD045445483. The USEPA Bureau of Federal Case Management (BFCM) assumed oversight of the NLF in November 1995, in addition to other applicable areas of concern.

The NLF is currently in Interim Status and will be closed pursuant to the requirements for RCRA landfills specified in 40 CFR 265.310 (Landfills). The materials will be managed as Hazardous Materials, meeting the RCRA treatment requirements and land disposal restrictions of 40 CFR 268 – Land Ban Restrictions. Closure plans which included capping of the landfarm were submitted to the NJDEP in December 2003 and March 2006 with revisions submitted in November 2007. The NJDEP indicated in June 2009 that sufficient information exists to proceed with the closure plan. In May 2013, Hess submitted Draft Soil and Groundwater Remedial Action Permits. A Remedial Action Workplan (that presents the final closure and post-closure monitoring plan specific to the North Landfarm) will be finalized in the fourth quarter of 2015 and submitted to the USEPA and NJDEP.

Several soil investigations were conducted between 1980 and 2009 at the NLF as part of previously approved closure activities. The soil sampling results indicated, in general, that elevated contaminant concentrations of TPHC and the volatile organic compounds benzene, toluene, ethylbenzene, and xylene (BTEX) were detected

in near-surface soils and as deep as 10 feet below grade.

Seven (7) permitted monitoring wells, designated LN-1 through LN-7, were installed along the western and northern exterior perimeters of the NLF. These wells are sampled on a quarterly basis in accordance with the NJPDES permit until closure of the landfarm is completed. The permit's required analyses are for VOCs, metals, general chemistry, pesticides, and radium/radionuclides. The groundwater sampling results indicated, in general, that metals and general chemistry parameters have continuously been presented at levels above applicable NJDEP GWQS. The other compound suites had no detectable compounds above applicable GWQS. The results of the quarterly sampling are reported to the NJDEP on a semiannual basis, with the latest report submitted on June 30, 2015.

5.2 Historic AOC-2 South Landfarm

The South Landfarm (SLF) was constructed in 1975 above a former surface impoundment that received oily wastewaters and its location is presented on **Figure 5**. The South Landfarm was operated from 1975 to 1984 to treat oily soils and oily sludges from the onsite API separator, corrugated plate separator, recoverable (slop) oil tank bottoms, and petroleum product storage tank bottoms. Hess requested initial closure of this Landfarm in May 1984, after it was determined that this Landfarm could not be expanded and may not meet the RCRA land treatment regulations that specify there be a minimum of three feet of soil between the bottom of the treatment zone and the top of the seasonally high water table. This AOC is located within AOC 13, the Former Oily Water Lagoon.

Hess submitted a Closure Plan in 1984, which was approved by the NJDEP in April 1985. The NJDEP conducted an inspection in December 1985 and found some permit exceedances in groundwater monitoring data. At that point, the NJDEP requested that an Assessment Plan be prepared for the SLF. Hess submitted an Assessment Plan and Addendum in July 1986 and October 1986, respectively. Hess submitted a Revised RCRA Closure Plan in April 2006 (Capping) and a NJDPDES Permit Application in June 2006 (Post Closure Monitoring). Quarterly groundwater monitoring will continue at the SLF until closure of the landfarm is completed. The results of the quarterly sampling are reported to the NJDEP on a semiannual basis, with the latest report submitted on June 30, 2015.

The NJDEP indicated in June 2009, that sufficient information exists to proceed with the closure plan. In May 2013, Hess submitted Draft Soil and Groundwater Remedial Action Permits. A Remedial Action Workplan (that presents the final closure and post-closure monitoring plan specific to the SLF) will be finalized in the fourth quarter of 2015 and submitted to the USEPA and NJDEP.

Several soil investigations were conducted between 2002 and 2006 at the SLF. The soil sampling results indicated, in general, that elevated contaminant concentrations of the volatile organic compounds benzene, ethylbenzene, and xylene were detected in near-surface soils and as deep as 10 feet below grade. Elevated concentrations of the metals lead and copper were randomly detected above their applicable NJDEP SRS.

Four permitted monitoring wells, designated LS-1 through LS-4, were installed along the four exterior perimeter sides of the SLF. These wells are sampled on a quarterly basis in accordance with the NJPDES permit until closure of the landfarm is completed. The permit's required analyses are for VOCs, metals, general chemistry, pesticides, and radium/radionuclides. The groundwater sampling results indicated, in general, that metals and general chemistry parameters have continuously been presented at levels above applicable NJDEP GWQS. The other compound suites had no detectable compounds above applicable GWQS.

5.3 Historic AOC-3 No. 1 Landfarm

The No. 1 Landfarm (1LF) was constructed in 1985 with a leachate collection system and underlying compacted clay liner and is depicted on **Figure 5**. It was designed to prevent any leachate discharges into the groundwater. The No. 1 Landfarm is an approximately 170,000 square foot basin and previously received and treated API Separator sludge, heat exchanger bundle cleaning sludge, leaded tank bottoms, and Tetra Ethyl Lead (TEL) bottoms.

NJDPES Permit No. NJG0225720 was issued by the NJDEP in November 2013. According to this permit, leachate was to be pumped from No. 1 Landfarm and treated via a filter bag and carbon filtration, then discharged to the Arthur Kill via the North Drainage Ditch. The department determined that the discharge constituents met the eligibility criteria for the General Petroleum Product Cleanup Permit. A Remedial Action Workplan (that presents the final closure and post-closure monitoring plan specific to the No. 1 Landfarm) will be finalized in the fourth quarter of 2015 and submitted to the USEPA and NJDEP.

The NJDEP originally approved a groundwater monitoring network of six monitoring wells (L1-1 through L1-4, BG-2 and BG-3). The monitoring network was expanded in October 2012 to include the NLF monitoring wells (LN-1 through LN-7, LPG-2, PER-4, SP-1 through SP-3, and TF-1 through TF-3) in order to gain a better understanding of regional groundwater flow. Groundwater flow beneath the No. 1 Landfarm is consistently northward to the North Drainage Ditch.

The most recent groundwater samples were collected in July 2015 from monitoring wells L1-1 through L1-4, BG2 and BG-3. Groundwater samples from wells L1 -1 through L1 -4, BG-2 and BG-3 were analyzed for the EPA's Priority Pollutants List with a library search for forty TICs (PP+40), not including the Pesticide and Polychlorinated Biphenyls (PCBs) portion of the list. Additional analytical parameters included methyl tertiary butyl ether (MTBE), tertiary butyl alcohol (TBA), cyanide, ammonia and pH. No VO or BN target compounds were detected above their respective NJDEP GWQS. Analytical results identified arsenic at concentrations that exceeded its GWQS in all groundwater samples collected. In addition, lead was identified above its GWQS in monitoring wells L1-1, L1-3, and L1-4 and antimony was identified above its GWQS in monitoring well L1-4.

In addition to the groundwater sampling conducted in July 2015, a landfarm leachate sample, designated as L1- Leachate, was collected and submitted for analysis. The results of the leachate sampling indicated that no VO or BN target compounds were identified above the NJDEP GWQS. Analytical results identified arsenic at 4.3 parts per billion (ppb), which exceeds the GWQS of 3 ppb. In addition, Nickel was identified at 422 ppb, above its GWQS of 100 ppb.

Two (2) lysimeters have been installed and maintained around the perimeter of the No. 1 Landfarm. Sampling of the lysimeters is conducted annually for select VOs, BNs, Metals and general chemistry parameters, as determined by the NJPDES operating permit. Lysimeter results are used as an indicator of the quality of the soil-pore liquids in the unsaturated zone under the Landfarm (or at background) and are used to help determine whether the regulated units have had a potential release of hazardous constituents into the subsurface soils or groundwater.

As per the NJPDES/DSW B4B Permit (No. NJG0225720), soil core sampling is conducted annually in the unsaturated zone of the No. 1 Landfarm, three randomly distributed soil cores are collected and composited for each fraction sampled. The landfarm is divided into grids, each grid is assigned a number, and a random number generation program is used to designate sample locations. A Zone of Incorporation (ZOI) sample is collected from 0.5-1.0 feet bgs, a Treatment Zone (TZ) sample is collected from 1.5-3.0 feet bgs, and an Unsaturated Zone (UZ) sample is collected from 3.0-4.0 feet bgs, analysis is conducted for select VOs, BNs, general chemistry and metal compounds. Soil core sampling was conducted in July 2015 as part of the annual sampling program.

With the exception of arsenic, antimony, nickel, and lead, groundwater concentrations of VOs, BNs, and metals detected in the No. 1 Landfarm wells were within the applicable regulatory standards for the most recent July 2015 event. The arsenic and antimony concentrations are consistent with historic groundwater monitoring levels, are present in the upgradient wells, and do not appear to be attributable to the No. 1 Landfarm. Elevated lead concentrations in all wells will be monitored quarterly as part of the operating permit. The results of the July 2015 leachate sampling indicate that VOs, BNs, and metals were not detected above the GWQS, with the exception of arsenic and nickel. Arsenic and nickel concentrations are consistent with previous sampling events.

5.4 Historic AOC-4 Dredge Spoils

The Dredge Spoils is a vacant approximately 100,000-square foot area located along the central-northeastern property boundary as shown on **Figure 5**, and westerly adjacent and upgradient to the No. 1 Landfarm. Historic aerial photography documents active filling of the area between 1954 and 1957. The area was filled with dredged materials (ranging in depth from 4.5 to 7.5 feet) believed to have originated from the adjacent Arthur Kill shipping channel. The area became an AOC in 1987 when the NJDEP requested a Groundwater Assessment Program pertaining to concentrations of benzene and chlorobenzene detected above the NJDEP GWQS during the initial 1985 sampling of No. 1 Landfarm monitoring well L1-2, which was installed within the Dredge Spoils area.

Subsequent soil, groundwater, and surface water investigations conducted for the Dredge Spoils AOC between 1987 and 2012 documented concentrations of targeted compounds, including benzene and chlorobenzene, as either non-detect (ND) or below the applicable NJDEP standards. However, groundwater samples collected from monitoring wells L1-1, L1-3, L1-4, and BG-2 between 1989 and 1991 contained benzene above its 1 ug/l GWQS. Available quarterly groundwater monitoring data pertaining to monitoring well L1-2 (dating from January 2005 to April 2015) showed benzene and chlorobenzene as not detected or at concentrations below their respective GWQS, with the exception of chlorobenzene (65.7 ug/l), which was detected above its GWQS of 50 ug/l in October 2011. The September 2012 Remedial Investigation Report noted that the historic exceedances in the 1LF monitoring wells were due to historical refinery operations and the constituents have attenuated and closure was requested for AOC 4.

Soil and groundwater investigations conducted at AOC-4 indicate that impacts are not evident as contaminant levels are below applicable NJDEP standards. Monitoring well L1-2 and the other 1LF monitoring wells are presently monitored and will continue to be sampled on a quarterly basis. Closure of AOC-4 will be recommended.

5.5 Historic AOC-5 Aeration Basins

Three (3) aeration basins located in the southeastern portion of the property, as shown on **Figure 5**, were utilized for wastewater treatment between 1974 and 1985. The synthetically-lined aeration basins were used for biological treatment of process wastewater and stormwater for refinery operations and then as final polishing ponds for terminal stormwater runoff. The aeration basins received treated stormwater from the existing API separator and the corrugated plate separators (used to capture free oil and collect petroleum hydrocarbons from Terminal operations) in 1974. The total surface area of the three basins is approximately 4.1 acres (including surrounding dike areas). Ground water flows into the three basins from the northeast. Five monitoring wells, AB-1 to AB-5, are installed on the east, south, and west sides of the basins. In 2002, a groundwater sample collected from monitoring well AB-3 was found to contain the VO compound benzene at 75.9 ug/l (above its GWQS of 1 ug/l), as well as several BN compounds below applicable GWQS.

When the new Advanced Water Treatment System was installed, the three aeration basins were no longer needed. A closure plan for the aeration basins was submitted in February 1987. According to a 2002 Beneficial Reuse Plan, the east aeration basin had been completely filled in 2001 with pre-approved material in accordance with the closure permit. The fill material is dewatered catalyst fines mixed with concrete in order to stabilize the

basin. The remaining basins, Basin 1 and Basin 2, were completely filled in 2014. A cap over the basins, consisting of a one-foot soil layer and six inches of top soil, was completed by the end of 2014.

5.6 Historic AOC-6 HSWA UST

The HSWA UST area is located in the central portion of the Site, within the Third Tank Field, east of Tanks 1217 and 1218. Its location is presented on **Figure 5**. In 1986, a 500-gallon underground storage tank (UST) was removed from this area. The UST was utilized for the temporary storage of water drained from the adjacent aboveground bulk petroleum storage tanks and any potential hydrocarbons carried with the water. The removal of the UST was prompted by the modernization of the facility's wastewater treatment system. In April 1988, the investigative and remedial requirements for AOC-6 were incorporated into HSWA Permit No. NJD045445483 as a SWMU. Subsequently, soil investigations had been performed leading to a 1994 recommendation for a bioremediation plan which was approved by the EPA in 1995. The plan was not implemented because it was not compliant with the then-current NJDEP Technical Regulations.

In 2010, delineation soil sampling of AOC-6 was performed. Two soil samples indicated the presence of EPH at concentrations above 1,000 mg/kg and were further analyzed for contingency VO, BN, metals, and PCBs. Tested compounds were not detected above the applicable NJDEP SRS. In 2012, additional soil delineation was conducted in which VO and BN target compounds were either not detected or below the applicable NJDEP standards. However, several metals were detected above the applicable NJDEP standards.

Groundwater investigations of AOC-6 were conducted in 2011 and 2012 and included the installation of temporary well points on all four sides of the former UST. Analytical data indicated elevated concentrations of the VO compound benzene, the PAH compounds benzo(b)fluoranthene, benzo(a)anthracene, and benzo(k)fluoranthene, and several metals above the applicable NJDEP GWQS.

5.7 Historic AOC-7 Central Colonial Pipeline

On May 14, 1991, Hess reported a release of unknown hydrocarbons. The NJDEP suspected the source of the impacts was within the central on-site portion of the Colonial Pipeline. This subsurface pipeline's right-of-way roughly transects west-to-east mainly along Avenue B as shown on **Figure 5**. The release, designated AOC-7, encompasses an area located along the right-of-way in the center of the Site, between the SLF and the Advanced Wastewater Treatment Area. In October 1991, a subsurface investigation was conducted in which soil and groundwater samples were collected for laboratory analysis. These samples delineated the footprint of released product along the right-of-way and in the area curving southwestward toward the Smith Creek Detention Basin (AOC-12).

In 1994, nine (9) monitoring wells, PL-1 through PL-9, were installed within AOC-7. Up to the present time, these wells have been gauged on a monthly basis, sampled on an annual basis, and the results reported in Quarterly Progress Reports. Historically, LNAPL has been detected in several of these monitoring wells. Monthly LNAPL recovery was conducted from these wells (with the exception of monitoring wells PL-4 and PL-8) from 1998 through 2014. The January 2012 Quarterly Progress Report concluded that impacts of AOC-7, toward the north and west, merge with the groundwater impacts of the SLF (AOC-2) and the Former Oily Water Lagoon (AOC13), and that the groundwater impacts from each of these areas were commingled.

5.8 Historic AOC-8 Waste Container Storage Area

The Waste Container Storage Area is located on the southwestern portion of the Site between the Truck Loading Rack and the Detention Basin as shown on **Figure 5**. In 1992, the area was proposed to the NJDEP as additional space to expand an existing container storage area for hazardous waste storage. Subsequently, the NJDEP issued hazardous waste storage permit (No.1225L1HP01) for the area. Hess stated in an August 26, 1996 letter to the NJDEP that the permit would not be renewed and the plans to expand the storage area were terminated. The NJDEP granted closure for the existing hazardous waste storage area in January 1997, indicating that all of

the applicable closure requirements were met. The hazardous waste storage permit was allowed to expire on March 3, 1997.

Pre-construction soil samples were collected from the near-surface in 1992. The soil sample analyses identified concentrations of cadmium, PCBs, benzene, ethylbenzene, and total xylenes that exceeded the NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC) or the Impact to Groundwater Soil Screening Levels (IGWSSL). Supplemental soil sampling of the same locations was conducted in 1993 and PCBs were detected at concentrations above the NJDEP IGWSSLs. Continued soil sampling was performed to delineate previous exceedances at AOC-8. PCBs, benzene, and metals were detected above the NJDEP standards at multiple locations. It was previously concluded, in the July 2012 Quarterly Progress Report, that the parameter suite detected in soils at AOC-8 differs from other areas at the site and that AOC-8 will remain independent from other AOCs with regard to soil conditions.

Groundwater samples were collected in 2010 to assess potential leaching associated with AOC-8 soil impacts. The sample analyses indicated the presence of multiple VO and BN compounds in exceedance of the applicable NJDEP GWQS. It was stated in the January 2011 Quarterly Progress Report that petroleum impacts in AOC-8 were suspected to be related to a 1991 discharge (Case # 91-9-25-1014-00) at the API Separator and not attributed to waste storage operations. In June 2012, groundwater samples were collected from the north, south, and west sides of the Waste Container Storage Area. The analytical results of these samples indicated the presence of the VO BTEX and CVOC suites, BNs (including various PAHs), and metals (arsenic and lead) at concentrations above the NJDEP GWQS. It was concluded, in the January 2013 Quarterly Progress Report, that organic compounds in the groundwater at AOC-8 did not correlate with the historical data and that groundwater impacts at AOC-8 are associated with the adjacent Alkylation Unit (sewer line) (AOC-9) and the Truck Loading Rack (AOC-10).

5.9 Historic AOC-9 Alkylation Unit (Sewer Line)

The Alkylation Unit process area consists of 11 catch basins connected to piping from process neutralization tanks and stormwater runoff collection points. This AOC is shown on **Figure 5**. The catch basin piping system ultimately connects to the inlet of the refinery API separator at the Alkylation Wastewater Treatment System (AWTS). Beneath the process unit area is a 6 inch thick concrete pad. Beneath the concrete pad is approximately 5 feet of fill material that overlies native silty clay. It should be noted that all process sewers were cleaned and sealed as part of the decommissioning process, however, the storm sewers have not been sealed.

In October 1992, the Alkylation Unit sewer system was cleaned as part of a regularly scheduled maintenance program. The maintenance program included an internal inspection of the sewer system using a remote camera. The video inspection showed that the piping was deteriorating near catch basins designated as CB-4, CB-5, and CB-6. The NJDEP was notified of a potential catch basin leak (NJDEP Case # 92-10-28-1052-59). One sample was obtained below the concrete pad surrounding each catch basin (for a total of 3 samples). VOCs (including benzene and chlorinated compounds) and PAHs were detected above at least one of NJDEP's Soil Cleanup Criteria (SCC) in effect at that time. Soil was excavated from the area and the catch basins and piping were replaced. The contaminants of concern include VOCs, SVOCs, acids, and bases. Several contaminants exceed Impact to Groundwater Quality Standards and NJRDCSCC.

In May 2007, a leaking drain pipe was identified within the Alkylation Unit area. The drain pipe was utilized to drain sulfuric acid in the alkylation unit. The leak was repaired and approximately 6 cubic yards of soil were removed. The NJDEP was notified and NJDEP Case # 07-05-11-1330-47 was assigned.

According to a Remedial Investigation Report, submitted on December 31, 2012 for AOC 9, in October 2009, five (5) temporary wells (AU-TW-1 through AU-TW-5) were installed to investigate and delineate possible groundwater impacts. Groundwater collected from wells AU-TW-2 and AU-TW-5 indicated the presence of benzene and VO TICS at levels exceeding the GWQS. Additionally, groundwater collected from well AU-TW-2

exceeded the GWQS for benzo(a)anthracene and 2-methylnapthalene.

Two additional temporary wells (AU-TW-6 and AU-TW-7) were installed to delineate groundwater impacts. A sampling event conducted in June 2012 indicated benzene, VOC TICS, and multiple SVOC were reported above the GWQS. Additional analysis reported the target metals (aluminum, arsenic, beryllium, cadmium, chromium, iron, lead, manganese, nickel, and sodium) in excess of the GWQS. Two additional temporary wells were proposed, but their locations were underlain by more than two feet of concrete and they were not installed.

In addition to the temporary wells specific to the assessment of AOC 9, temporary wells were installed in the immediate area of Historic Spill 6 (HS-6), which is downgradient of AOC 9. Historic Spill HS-6 was a June 1992 spill of 40 to 50 gallons of FCCU feedstock and No. 2 fuel oil from an aboveground line. In June 2012, temporary wells HS6-TW-5 through HS6-TW-10 were installed to delineate groundwater to the south. Analytical results reported all targeted VOC and SVOC compounds as either not detected or at concentrations below the respective NJDEP GWQS. The only exception was the detection of benzene, which was reported at upgradient location HS4-TW-9.

5.10 Historic AOC-10 Truck Loading Rack

The Truck Loading Rack is currently (and historically) located in the southwestern portion of HC-PR and is used to load customer fuel trucks with gasoline, heating oil, and diesel fuel. This AOC location is depicted on **Figure 5**. In April 1993, a spill, referred to as Historic Spill HS-8, occurred when corroded floor plates in the rack tank (Tank 1176) allowed the release of approximately 84 gallons of No. 2 fuel oil. Subsequently, Case Number 93-4-30-1638-14 was assigned to the incident.

On October 21, 1993, after heavy rainfall, gasoline was detected on a concrete turn-around area at the loading rack and NJDEP Case Number 93-10-21-1435-21 was assigned. Inspection of the oily water sewer box in the vicinity of the observed gasoline indicated a mixture of gasoline and water draining into the sewer box from the subsurface. Samples obtained from the sewer box indicated the product to be oxygenated regular grade gasoline.

A vacuum truck was used to recover product that collected in the sewer box while cleanup of the concrete surface was completed. No surface water or off-site impacts were documented from this incident. On November 1993, four (4) ground water monitoring wells were installed (TR-1 through TR-4, formerly known as MW-1 through MW-4). Free product was observed in monitoring well TR-2 (three feet in thickness) and product recovery was conducted on this monitoring well using a vacuum truck. During a gauging event in March 2008, monitoring well TR-2 was observed to contain 0.09 feet of product.

The third incident occurred in November 1997, referred to as Historic Spill HS-13, when approximately 50 gallons of gasoline escaped from the Vapor Recovery Unit (VRU) stack and Case Number 97-11-7-1647-16 was assigned. All material was cleaned up and properly disposed of.

The fourth incident occurred in May 2006 (identified as Historic Spill HS-10) when a fuel line from a diesel pump failed, and approximately 1 gallon of diesel was released. The final documented release occurred in August 2008 when gasoline was observed to be flowing from the storm water system in the Truck Loading Rack tank field during a rainfall event. Case Number 08-08-14-0949-36 was assigned and the gasoline was determined to be residual in the drainage system from a past release.

In October 2009, seventeen (17) temporary wells (TR-TW-1 through TR-TW-17) were installed to investigate and delineate groundwater impacts. Two (2) monitoring wells (TR-5 and TR-6) were installed on October 2010. Seven (7) additional temporary wells (HS8-TW-1 through HS8-TW-7) were installed in and around the Loading Rack Tankfield and three (3) temporary wells (DC-TW-1 through DC-TW-3) were installed to the northeast of AOC 10 in June 2012.

On November 9, 2012, a Remedial Investigation Report (RIR) was submitted to the NJDEP detailing the investigation activities at AOC-10. Groundwater samples were collected from five monitoring wells (PER-1, PER-2, TR-2R, TR-5 and TR-6). The samples were analyzed for VO+10, MTBE, TBA via USEPA Method 624, and BN+15 via USEPA Method 8270. Analytical data indicated that all targeted VOCs were either not detected or concentrations were below the respective GWQS (with the exception of benzene, MTBE and xylenes in TR-2R; benzene, ethylbenzene, MTBE and TBA in TR-5; and benzene, MTBE, and TBA in TR-6). Data also showed that all targeted SVOCs were either not detected or concentrations were below the respective GWQS, with the exception of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, naphthalene, 2-methylnapthalene, and SVO+TICs in TR-2R; bis(2ethylhexyl)phthalate in PER-2 and TR-6; and SVO+TICs in TR-5 and TR-6.

Several temporary monitoring wells were also installed in the area of AOC 10 in order to delineate shallow groundwater impacts. According to the 2012 RIR, shallow groundwater has been delineated in AOC 10. Hess installed a recovery trench and a recovery sump at the Truck Loading Rack to collect product. The trench is approximately 150 feet long and 2 feet deep and is lined with 20 mil reinforced polyethylene sheeting on the base and downgradient sidewall. A 4-inch perforated pipe was installed in the bottom of the trench and backfilled with 3/4-inch clean gravel. A 6-inch layer of asphalt was placed atop the gravel to match existing grade. Approximately 20-feet of the trench at the sump end was lined with concrete and the sump itself was encased in concrete. The sump consists on an 18-inch diameter section of PVC pipe, which is approximately 5-feet long and is installed vertically into the ground. Horizontal slots were cut partially around the sump to line up with the bottom of the trench. A steel manhole cover was installed atop the sump for access.

Initially, a vacuum truck was utilized on a weekly basis to remove all collected product from the sump. However, as the amount of recovery slowed, removal is now conducted manually. A pump is used to remove product and is placed into a 55-gallon drum located in the waste storage area behind the Truck Loading Rack. When the drum is close to capacity, a vacuum truck is dispatched to the Site and the contents are removed. Approximately 25-gallons of product has been recovered as of October 2015.

5.11 Historic AOC-11a Administration Building

A Chain-of-Title review indicated that the parcel was owned by Petroleum Solvents Corporation (PSC) from 1945 to 1955. This AOC is depicted on **Figure 5**. During the early 1990s, USTs were removed from the area of the current Administration Building. Soil and groundwater investigations have demonstrated the existence of a plume of dissolved chlorinated solvents extending south-southeast from the Administration Building. These impacts have been attributed to a reported Quality Control laboratory within the Administration Building that was closed in 1974.

The four USTs were designated as Tanks 0012 through 0015. A summary of the removal date, tank size, and contents for each tank is shown below:

Tank ID	Size (gallons)	Contents	Removal
0012	550	Unknown	8/30/1990
0013	3,000	#2 fuel oil	8/30/1990
0014	2,000	#2 fuel oil	8/30/1990
0015	5,000	#6 fuel oil	8/30/1990

Following the removal of the USTs, stained soil and petroleum odors were noted within the excavations. The NJDEP was notified and NJDEP Case Number 90-08-29-1617 was assigned. Free product was encountered within the excavations and collected with a vacuum truck. Soil saturated with product was excavated and removed from the site. A Remedial Investigation Workplan (RIW) detailing a soil sampling plan was submitted in August 2013. No soil sampling results were available for review in the RIW.

Five (5) monitoring wells (AD-1 through AD-5) are located adjacent to the Administration Building. Subsequent to the UST removal, various soil and groundwater investigations have been completed. The issues regarding the USTs and soil and groundwater conditions near the administration building have been designated as AOC-11. AOC-11 also includes former UST locations and monitoring wells immediately north of the HC-PR Training Center along West Avenue (Tanks 0016 and 0017). The Training Center is discussed in Section 8.1.12, which summarizes AOC-11b.

An indoor air investigation was conducted for the Administration Building on June 14, 2007. Five canisters were placed throughout the building. The results of the indoor air samples indicate the presence of benzene and methylene chloride above the NJDEP non-residential screening levels in the first floor sample. Additionally, chloroethane was detected above non-residential screening levels in the western basement. On November 10, 2010, two sub-slab soil gas samples were collected from below the slab of the building. Results indicated chloroform and p-dichlorobenzene were present in the sub-slab above Non-residential soil gas screening levels. Subsequently, an indoor air investigation was conducted within the building. Six (6) indoor air samples were collected from within the administration building. According to the EnviroTrac Receptor Evaluation submittal dated February 28, 2011, laboratory analysis identified no contaminants above the NJDEP's Indoor Air Screening Levels (IASL). A Vapor Intrusion (VI) Sampling Form and Spreadsheet, Full Laboratory Deliverables Form and associated laboratory data, and the Electronic Disk Deliverables (EDDs) conversion tables were submitted to the NJDEP, USEPA, and New Jersey Department of Health.

5.12 Historic AOC-11b Former Training Center

The Former Training Center is located outside of the facility gates at the adjacent parcel identified as Block 666, Lot 30. This AOC is shown on **Figure 5** and is formerly known as the Port Reading Recreation Center. The current Training Center Building was constructed between 1957 and 1963 and was used by Hess as a training facility until the 2013 sale of the refinery/terminal property to Buckeye. Hess retained ownership of the Former Training Center parcel, but has not used the facility for training since the cessation of Hess' refinery/terminal operations in 2013.

On August 22, 1991, two (2) 3,000-gallon #2 fuel oil USTs, designated as Tanks 0016 and 0017, were removed from the area adjacent to the northern corner of the building. Hudson Environmental Services Inc. provided oversight for the removal and submitted documentation in a UST Site Assessment Report dated February 2, 1992. Tank 0016 measured 17.8-feet in length and 5.3-feet in diameter and was constructed of steel and catholically protected. At the time of removal, no holes or signs of corrosion were noted in the UST and no stained soils were observed. However, Hudson noted petroleum odors, sheen on the groundwater within the UST excavation, and a sheen on the soil/water during an agitation test. Soil samples were collected from the UST excavation, results of which revealed concentrations of TPHC below the applicable standard with the exception of one sample above the soil action level. The UST was backfilled with in-situ soils and clean fill.

Tank 0017 was discovered approximately 18-feet from UST 0016. UST 0017 was also constructed of steel and measured 18-feet in length and 5.4-feet in diameter. Free-floating product was observed on groundwater within the Tank 0017 excavation and petroleum odors were noted. No visible signs of holes or corrosion were noted in the UST. The NJDEP was subsequently notified and NJDEP Case Number 91-08-22-1911-24 was assigned to the release. Analysis of soil samples collected from the Tank 0017 excavation showed concentrations of TPHC and BN+15 above the NJDEP soil action levels. The impacted soils were removed, disposed of, and the excavation was backfilled with clean fill. Hudson proposed no further soil excavation due to the close proximity of the impacted soils to the existing building.

In October 1991, three (3) monitoring wells (TC-1 through TC-3) were installed to the north, east, and to the south of the impacted area. Hudson conducted two (2) rounds of groundwater sampling, results of which indicated "low" concentrations of chloroform and/or SVOCs at more than one location. Hudson concluded that no further investigation was necessary and requested closure in the Discharge Investigation and Corrective Action Report dated March 11, 1992 for the Former Port Reading Recreation Center. The NJDEP subsequently requested

further soil investigation of the AOC. Hudson conducted the additional soil sampling in August 1992 and laboratory data indicated contaminant levels below the applicable NJDEP standards. An NFA request was presented in the Hudson Remedial Investigation Addendum Report dated September 18, 1992. The NFA was granted by NJDEP in February 1995.

In a March 24, 1993 letter, the NJDEP requested that Hess enter into a Memorandum of Agreement (MOA) for a PA/SI to determine previous site owners and land use as part of the Department review of the Hess Remedial Investigation Addendum Report II. Hess' response letter dated November 3, 1994 requested minor revisions to the MOA, including correcting the Case Number to the number originally assigned to the UST Discharge (Case Number 91-08-22-1911-24). The November 30, 1994 MOA lists Case Number 94-10-5-1620-28 with the Port Reading Recreation Center (Block 666, Lot 30). Hess correspondence to the NJDEP dated December 7, 1994 referenced both case numbers. The NJDEP later granted NFA in a letter dated February 7, 1995 for Case Number 94-10-5-1620-28, which included the removal of #2 fuel oil USTs and the sampling of three (3) monitoring wells. The letter stated that the approval was based on the information provided in the March 12, 1992 Site Investigation Report and the November 30, 1994 MOA. Based on the available historical documents, it is unclear as to why Case Number 91-08-22-1911-24 was replaced with Case Number 94-10-5-1620-28. However, it is clear that the latter case number was associated with the same release from the #2 fuel oil USTs removed from the site, which was granted NFA.

According to NJDEP's *Technical Requirements for Site Remediation (TRSR)*, an order of magnitude analysis is required to determine if there is an order of magnitude difference between the concentration of any contaminant in any area of concern and any remediation standard applicable at the time of comparison to the area of concern, if there is a prior final remediation document for the area of concern. If there is an order of magnitude difference, then the person responsible for conducting the remediation shall evaluate the protectiveness of any existing engineering or institutional controls on the area of concern and otherwise determine whether additional remediation may be required at the area of concern to ensure the area of concern remains protective of public health, safety, and the environment.

The February 1995 NFA determination issued by the NJDEP is considered the final remediation document for AOC-11b. An order of magnitude analysis was performed on both soil and groundwater samples collected at AOC-11b. Laboratory analysis indicated that benzo(a)pyrene was detected in soil sample RC-3 at 0.802 parts per million (ppm), which exceeds the current NJDEP Direct Contact Residential and Non-Residential Direct Contact Soil Remediation Standards (DCRSRS and NRDCSRS respectively) (0.2 ppm), as well as the current Impact to Groundwater Soil Screening Level (IGWSSL) (0.2 ppm). However, this sample does not exceed the current standards by an order of magnitude or greater, and therefore, no further action is warranted with respect to this AOC.

In addition, an order of magnitude analysis was also performed on the groundwater sampled collected at this AOC. Monitoring well MW-3 had one tested compound (N-nitroso-di-n-propylamine) that exceeds the current NJDEP Groundwater Quality Standards (GWQS). However, this compound does not exceed the current standard by an order of magnitude or greater, and therefore, no further action is warranted with respect to this AOC. The order of magnitude analysis comparison tables are provided in **Appendix 3**.

The three (3) monitoring wells (TC-1 through TC-3) are currently active at the site and monitored on an annual basis. Results of the most recent (November 2014) sampling event, as well as events conducted from 2009 through 2013, showed concentrations of VOCs and SVOCs of ND or below the applicable NJDEP GWQS at all three (3) wells. Metals were detected at more than one location above the NJDEP GWQS, however these exceedances were attributed to background conditions.

Groundwater sampling conducted at AOC-11b indicated that contaminants are not present above applicable NJDEP standards in groundwater. Historical documentation has indicated that the NJDEP considered the release from the former #2 fuel oil USTs fully remediated and granted NFA in February 1995. Based on the above information, no further investigation is proposed for this AOC.

5.13 Historic AOC-12 Smith Creek and Detention Basin

The head waters of Smith Creek are located on the southern portion of the property. This AOC is shown on Figure 5. In the 1960's, the creek was extended from the Arthur Kill to the Port Reading Coal Dock. The creek has been progressively filled in over time. In October 1969, a crude oil tank failure occurred and approximately 8 million gallons of crude oil were released into the creek. As a precaution, Hess installed a berm at Smith Creek to prevent further discharge to the creek.

The PSE&G substation and a sewage disposal facility are located south of AOC-12. There have been no previous investigations completed for this AOC. In a September 2007 RIW, Hess proposed to collect 12 sediment samples to assess and/or delineate potential impacts to the creek. The proposed locations focused on the detention basin, the headwaters of the creek, and along the historical groundwater flow path to the creek. In a May 21, 2008 response, the NJDEP issued a notice of deficiency letter regarding the RIW. The letter stated that "the remedial investigation workplan failed to delineate the horizontal and vertical limits of contamination to the applicable unrestricted use remediation standard for all media, as required by N.J.A.C. 7:26E-4.1(b)."

A revised RIW was submitted on October 21, 2008. This RIW outlines the collection of twelve (12) surface water samples and twenty-four (24) sediment samples from Smith Creek and the detention pond. Each sediment sample will be analyzed for total organic carbon, pH, particle grain size, and total petroleum hydrocarbons. Each surface water sample will be analyzed for full TCL/TAL+30. The RIW appears to have only partially been implemented, as only the detention basin groundwater data was available for review. The groundwater samples were analyzed for total dissolved solids, total suspended solids, and total organic carbon, and some samples were also analyzed for metals and salinity. Metals results indicated concentrations of iron, manganese, and arsenic above NJGWQS.

5.14 Historic AOC-13 Former Oil Water Lagoons

The Former Oil Water Lagoon area is comprised of three (3) former lagoons: the former Oily Water Lagoon (or Oil/Water Separator Lagoon), the former Mini-Lagoon, and the former Filter Backwash Lagoon. The all-encompassing former lagoon AOC is located between the Detention Basin and the SLF in the central-southern portion of the site. The lagoons were used for waste, oil/water disposal, and storm water management. In September 2014, AOC-13 was incorporated into the SRMU. The historical lagoon units that comprise AOC-13 and the SRMU are shown on **Figure 5**.

The Former Oily-Water Lagoon was located in the position of the present SLF. The SLF's footprint lies within the limits of the former Oily-Water Lagoon. This lagoon appears on historic aerial photographs for the years 1963 through 1972. It was constructed and utilized to handle stormwater run-off, wastewater, and oily water. The lagoon operated from the 1960's through 1974, when the Aeration Basins were constructed for the treatment of storm water and wastewater.

The Mini-Lagoon operated between approximately 1970 and 1984. This lagoon was constructed in the channel of the Smith Creek, immediately south of the SLF and adjacent to the northern portion of the Detention Basin. It appears on historic aerial photographs for the years 1972 through 1980. Floating product was separated at the API and water from the Mini-Lagoon was directed to the adjacent Detention Basin (AOC-12). The Former Mini Lagoon was previously included in AOC-7 (Colonial Pipeline), however it later became an individual AOC because it is a former waste management unit. The Filter Backwash Lagoon that was located beneath the current location of TK-1911 also operated during the years between 1974 and 1983. It appears on historic aerial photographs in 1979 and 1980.

Groundwater investigations were conducted for AOC-13 during the period between 2009 and 2012. VOCs, SVOCs (including PAHs), PCBs, ammonia, and metals (including lead and arsenic) were detected at concentrations above the applicable NJDEP GWQS.

Four (4) groundwater monitoring wells (LS-1R through LS-4) that were installed to monitor the SLF (AOC-2) lie within the footprint of the Former Oily Water Lagoon. During the most recent quarterly sampling events, conducted in January, April, and July 2015, VOCs, metals, and ammonia were detected at concentrations exceeding the applicable NJDEP GWQS. Monitoring wells PL-1R and PL-3R were installed within the footprint of the former Mini-Lagoon and are sampled annually. Results of the most recent sampling event conducted in November 2014, revealed VOCs (benzene and vinyl chloride), PAHs, and metals in well PL-1R at concentrations exceeding the NJDEP GWQS. PAHs, ammonia, and metals (including arsenic) were detected above the NJDEP GWQS in the groundwater sample collected from well PL-3R during the November 2014 sampling event.

Soil investigations were conducted during the period between 2006 and 2013 within the footprint of the Former Oily Water Lagoon and revealed the presence of EPH, VOCs, SVOCs, and metals at concentrations above their respective NJDEP IGWSSL, RDCSRS, and NRDCSRS. Extensive soil sampling was conducted within the SLF during this time as well, details of which are discussed in **Section 8.1.2**.

6.0 SITE INVESTIGATION – AREAS OF CONCERN

The following sections address all identified AOCs that required additional investigation as documented in the Preliminary Assessment Report. The sections present summaries of the soil and groundwater investigations for each AOC, some which were initiated in the 1980s (for the historic AOCs). All of the following AOCs are depicted on **Figure 5** as identified during the PA activities:

- Historic AOC-14a – First Tankfield;
- Historic AOC-15b – Former UST Area (USTs 0008 and 0009);
- Historic AOC-15c – Former UST Area (UST 0004);
- Historic AOC-16b – Marine Terminal Loading Rack Area;
- AOC-20a – T1600-A and T1600-B Transformers;
- AOC-20b – T510-A and T510-B Transformers;
- AOC-20c – T2606-A and T2606-B Transformers;
- AOC-21 – X-1933 (Adsorber Feed Sump);
- AOC-22 – X-1908 (Clarifier Lift Sump);
- AOC-23 – X-1904 (Storm Water Transfer Pump), S-1922 (Storm Water Corrugated Plate Separator), and X-1903 (Storm Water Diversion Manhole);
- AOC-24 – Sluice Pit;
- AOC-25 – X-1950A and X-1950B (Alkylation Neutralization Basin);
- AOC-26 – D-1104 (MEA Sump);
- AOC-27 – EADC Disposal Pit;
- AOC-28 – Cooling Water Tower;
- AOC-30 – Sulfur Pit;
- AOC-32 – X-1951 (SRU Neutralization Basin);
- AOC-33 – Truck Rack Sump 2;
- AOC-34 - X-1930 (Surge Pumping Station), X-1932 (API Splitter Box), X-1922A and X-1922B (API Separator), X-1926 (Stormwater Lagoon Sump), X-1924 (API Separator Oil Sump), S-1921A and S-1921B (Process Water Corrugated Plate Separator), X-1925 (API Separator Sump), API Truck Loading Area;
- AOC-35 – No. 1 Landfarm Discharge Sumps;
- AOC-38 – Former Ammonia Truck Loading Rack;
- AOC-40 – Fresh Acid Unloading Area;
- AOC-43 – Truck Unloading (Prover Truck) Area 1;
- AOC-44 – Truck Unloading (Prover Truck) Area 2;
- AOC-45 – Former Sulfur Recovery Unit Truck Loading Rack;
- AOC-46 – Slop Gasoline Unloading Area;
- AOC-47 – Bleach Truck Unloading Area;
- AOC-48 – Former Equipment Fuel AST;
- AOC-49 – Electrician Shop Diesel/No. 2 Fuel Oil ASTs;
- AOC-50 – Refinery Warehouse Diesel/No. 2 Fuel Oil ASTs;
- AOC-52 – TK-7925;
- AOC-53 – Second Tankfield;
- AOC-55 – Fourth Tankfield;
- AOC-56 – Second Reserve Tankfield;
- AOC-57 – Day Tankfield;
- AOC-58 – Former Chemical Storage Area;
- AOC-59 – API Storage Area;
- AOC-60 – Avenue D Tankfield;
- AOC-62 – Inactive Railroad Spur (between Canning Plant and QC Lab);

- AOC-63 – Former Rail Lines (Vacant Land North);
- AOC-64 – Inactive Railroad Spur (Administration Building);
- AOC-73 – TEL Building (North);
- AOC-74 – TEL Building (South);
- AOC-75 – Former Canning Plant AST;
- AOC-77 – Former Petroleum Solvents AST;
- AOC-80 – Former Crude Topping Unit;
- AOC-82 – Former Incinerator Building;
- AOC-84 – Former Tank North of Administration Building;
- AOC-85 – Marine Vapor Recovery Unit (VRU) – TK-4701 and TK-4801;
- AOC-86 – Truck Rack Vapor Recovery Unit (VRU);
- AOC-87 – Flare Knock Out Drum;
- AOC-88 – Compressor Building;
- AOC-89 – Cracking Tower;
- AOC-90 – Drum Compound (QC Lot);
- AOC-92 – TK-701A and TK-701B;
- AOC-96 – Boiler Area;
- AOC-99 – Chemical Storage Adjacent to Cooling Water Tower;
- AOC-100 – Laydown Yard;
- AOC-102 – Vacant Land (South);
- AOC-103 – Fire Pits/Fire Areas;
- AOC-107 – Drum Storage Compound;
- AOC-116 – Diesel Powered Emergency Generator – South Dock; and
- AOC-117 – Diesel Powered Emergency Generator – Millright's Shop

The findings of the soil and groundwater investigations are summarized in this report. All SI activities were performed to satisfy NJDEP requirements in accordance with N.J.A.C. 7:26E, *Technical Requirements for Site Remediation* (TRSR); N.J.A.C 7:26C, *Administrative Requirements for the Remediation of Contaminated Sites* (ARRCS); N.J.S.A. 58:10C-1 et seq., *Site Remediation Reform Act* (SRRA); *Field Sampling Procedures Manual (FSPM),* and the associated NJDEP Guidance Documents.

It has been documented throughout the years of sample collection and analyses that the former HC-PR property was developed by the placement of fill material upon topographically lower land, primarily wetlands. The NJDEP has documented the visible extent of wetland filling in **Figure 4**. The NJDEP has recognized that two contaminant suites are inherent with historic fill material. The suites are metals and base neutrals, especially its sub-set PAH's.

Historic soil and groundwater sampling data has documented a presence of metals and PAHs, in numerous instances at concentrations above applicable SRS and GWQS. With the exception of lead, the other metals that have been detected are not attributed to past on-site operations and are likely associated with the underlying historic fill material (arsenic, lead, mercury). To a lesser extent, BN and PAHs have been detected site-wide with locations also having concentrations above applicable SRS and GWQS. Although associated with historic fill material, it is recognized that the BN and PAH occurrences could also be associated with on-site operations. Due to metals' likely historic fill material origin, their presence in the following AOC section findings will be minimalized, with the focus of the investigative findings more toward contaminants that could have been generated from on-site activities. Also, any metal findings discussion or investigation will not include metals that the NJDEP deems associated with the potability of ground water, such as aluminum, calcium, iron, manganese, and sodium.

6.1 Historic AOC-14a First Tankfield

AOC-14a is located on the western side of the property within the refinery operations section of the site. The AOC is a double containment area that houses two ASTs identified as Tank 7943 and Tank 7944 as shown on

Figure 6. Current and historical storage within this AOC includes MTBE, TAME, Slurry Oil, Light Cycle Oil, Raffinate, Methanol, Process Water, Gasoline, and Sour Water.

Seven (7) soil borings, designated as TF1-SS-1 through TF1-SS-7, were installed in September 2014. A discrete soil sample was collected from each soil boring location for VO analyses. The analyses indicated that no VO compounds were detected above any applicable SRS.

Given the highly water soluble nature of the products stored within this AOC, four (4) monitoring wells (TM-1 through TM-4) were installed in this area. The November 2014 groundwater sampling analytical results indicate benzene and MTBE were detected in the groundwater sample collected from well TM-1. The BN analytical results indicate bis(2-ethylhexyl)phthalate was detected above the NJDEP GWQS in groundwater collected from wells TM-2, TM-3, and TM-4. Groundwater collected from wells TM-1 and TM-3 contained thallium concentrations in excess of the NJDEP GWQS.

6.2 Historic AOC-15 Former UST Areas

In November 1989, five (5) USTs were removed from the Third and Fourth Tankfields. These tank areas were later separated into three individual AOCs, designated as 15a (USTs 0010 and 0011), 15b (UST 0008 and 0009), and 15c (UST 0004). AOC-15a was determined in the PA to require no further investigation. The other two UST AOCs are addressed individually below.

6.2.1 Historic AOC-15b Former UST Area (USTs 0008 and 0009)

AOC-15b was the location of former UST 0008 (a 1,000-gallon #6 fuel oil tank) and former UST 0009 (a 550-gallon #2 diesel fuel tank), both of which were located to the eastern tank field, north of AST 1211 as depicted on **Figure 7**. Both USTs were removed in 1990, at which time it was noted that both USTs showed no visible signs of corrosion and there was no free product in either UST excavation. However, “discolored soils” were observed within both excavations. Soil samples were collected from the excavation sidewalls and analyzed for TPHC with results documenting concentrations exceeding the NJDEP SRS of 10,000 mg/kg at both UST excavations.

Soil investigations were conducted in 2010 and 2014 to delineate the impacts associated with the former USTs. Soil samples were analyzed for EPH and concentrations were below the NJDEP SRS during the investigations. Historical soil analysis documented TPHC concentrations above its applicable NJDEP standard around the perimeter of the UST excavations, with the delineation soil sampling (conducted in 2014) resulting in the horizontal delineation of soil impacts at both UST locations. Soil sampling locations are depicted on **Figure 7** and laboratory results are summarized in **Table 2**.

Groundwater investigations were conducted in the vicinity of AOC-15b in 2010 and 2012. During these initial investigations, VO and BN compounds were either not detected (ND) or at concentrations below their applicable NDJEP GWQS. Groundwater sampling utilizing temporary well points was again performed in October 2014 with samples collected for VO and BN analyses indicating that concentrations of VO (benzene, toluene, and trichloroethene) and a BN compound (benzo(a)anthracene) were above their respective NJDEP GWQS as illustrated on **Figure 8.** The groundwater analytical results are provided in **Table 3.**

6.2.2 Historic AOC-15c Former UST Area (UST 0004)

AOC-15c is designated for former UST 0004, a 550-gallon #6 fuel oil tank, which was located immediately northwest of AST 1209 as depicted on **Figure 7**. The UST was removed in 1990 and found to be intact with no holes observed in the UST. Soil samples were collected from the excavation sidewalls and analyzed for TPH, with results documenting concentrations exceeding the NJDEP SRS of 10,000 mg/kg.

Soil investigations were conducted in 2010, 2012 and 2014 to delineate the TPH exceedances identified in the soil around the former UST. Analytical results from sampling around the former UST area indicated that TPH and EPH were not detected, therefore impacts were confined to the former UST area only. The 2010, 2012 and 2014 sampling data does not appear to be representative of the conditions within the AOC, however the data did confirm that AOC-15c was not the source of chlorobenzene detected in monitoring wells at the No. 1 Landfarm. The soil analytical results are shown in **Table 4**.

A groundwater sample was collected from a temporary well point in October 2014 for VO and BN analyses. The VO analysis indicated that no compounds were identified above applicable GWQS, while the BN analysis indicated that the PAH compound benzo(a)anthracene was present above its NJDEP GWQS of 0.1 ug/l as shown in **Figure 8**. The groundwater analytical results for this AOC are summarized in **Table 5**.

6.3 Historic AOC-16b Marine Terminal Loading Rack Area

AOC 16b is located on the eastern side of the facility, at the marine terminal loading area depicted on **Figure 9**, and contains a truck loading rack area. Current and historical storage in the ASTs around AOC-16b include gasoline, gasoline blend stock, MTBE, diesel fuel, No. 2 fuel oil, jet fuel, methanol, sulfuric acid, sodium hydroxide, and monoethanolamine.

Soil investigations have been performed in the vicinity of AOC-16b in October 2014. The soil sampling analytical results documented impacts due to free product, TPH, and PAHs. The soil analytical results are summarized in **Table 6**.

Groundwater sampling was conducted concurrently with the soil sampling. Three of the soil borings were converted to temporary well points (TL-TW-14, TL-TW-15, and TL-TW-17). Groundwater samples were collected from each well point for VO and BN analyses. The VO analyses indicated that benzene, ethylbenzene, total xylenes and 2-methylnaphthalene were detected above their respective GWQS in well point TL-TW-17 as depicted on **Figure 10**. The VO analyses also indicated that isopropylbenzene and toluene were detected above their respective GWQS in well point TL-TW-17. The BN analyses indicated that chrysene, fluorene, naphthalene, phenanthrene, pyrene and 1,1-biphenyl were detected above their respective GWQS in well point TL-TW-17. Benzo(a)anthracene was detected above its 0.1 ug/l GWQS in well points TL-TW-14 and TL-TW-15. The groundwater analytical results are summarized in **Table 7**.

6.4 AOC-20 Transformers

Transformers that warranted additional investigation have been identified at three locations on the property. Below is a summary of investigative work performed at each transformer location.

6.4.1 AOC-20a – T1600-A and T-1600-B Transformers

Two (2) transformers located within the MTBE Unit, depicted on **Figure 11**, were labeled as “PCB Contaminated” and staining was observed beneath transformer T1600-B. Four borings, TFD-SS-1 through TFD-SS-4, were advanced at this AOC in July 2015 and one soil sample was collected from each boring for EPH-Cat 2 and PCB analyses. The PCB analyses did not indicate the presence of PCBs. The EPH analyses indicated that EPH was either not detected or present at concentrations below the NJDEP SRS. The soil analytical results are summarized in **Table 8**.

6.4.2 AOC-20b – T510-A and T510-B Transformers

Two (2) transformers are located south of the fracking tower, depicted on **Figure 12**, which were labeled as T-510A and T-510B. The two transformers were labeled "non-PCB" with no evident staining beneath both transformers. Four borings, TFFT-SS-1 through TFFT-SS-4, were advanced in July 2015 at this AOC with one discrete sample collected from each boring for EPH-Cat 2 and PCB analyses. The PCB analyses indicated that PCBs were detected above its total PCB RDCSRS of 0.2 mg/kg in sample TFFT-SS-1 (0.687 mg/kg). The EPH analyses indicated that EPH was detected in samples TFFT-SS-1 and TFFT-SS-4 at 6,780 mg/kg and 340 mg/kg, respectively. Due to EPH exceeding 1,700 ppm, the soil sample was fractionated and analyzed for the contingent PAH parameters. The PAH analysis indicated that benzo(a)pyrene was detected at 0.426 mg/kg, which exceeds its NRDCSRS of 0.2 mg/kg. The results of the fractionated EPH analysis were entered into the Composition-Specific Extractable Petroleum Hydrocarbon (EPH) Soil Remediation Criterion (SRC) Calculator (EPH SRC Calculator). The results indicate that sample TFFT-SS-1 passed the allowable EPH SRC (**Appendix 5**). The soil analytical results are summarized in **Table 9**.

6.4.3 AOC-20c – T2606-A and T2606-B Transformers

Two (2) transformers are located within the northern portion of the Waste Water Treatment facility, depicted on **Figure 13**, which were labeled as T2606-A and T2606-B. The two transformers were not labeled and staining was observed beneath transformer T2606-A during the PA site inspections.

Four borings, designated as TFWWT-SS-1 through TFWWT-SS-4, were advanced in July 2015 and one soil sample was collected from each boring for EPH-Cat 2 and PCB analyses. The PCB analyses indicated that PCBs were not detected or at concentrations below applicable NJDEP SRS. The EPH analyses indicated that EPH was detected in all samples ranging in concentration from 14.9 mg/kg to 652 mg/kg. Due to its elevated EPH concentration, Sample TF-WWT-SS-1 was analyzed for contingency PAHs. The PAH analysis indicated that no PAH compounds were detected in sample TF-WWT-SS-1 above their applicable SRS. The soil analytical results are summarized in **Table 10**.

6.5 AOC-21 – X-1933 (Adsorber Feed Sump)

A concrete platform and concrete pit identified as X-1933 – Adsorber Feed Sump, depicted on **Figure 14**, was an open sump that contained water. The concrete was stained around the sides of the sump, which had a steel pipe that discharged water into the structure.

Four borings (ADSF-SS-1 through ADSF-SS-4) were installed in April 2014 to investigate this AOC. One sample was collected from each boring and was analyzed for VO and Metals. Three of the locations (ADSF-SS-1, ADSF-SS-2, and ADSF-SS-3) were not sampled due to the presence of light non-aqueous phase liquid (LNAPL). The VO analysis of sample ADSF-SS-4 indicated that no compounds were detected above any RDCSRS or NRDCSRS. In addition, no metals were identified above their respective RDCSRS or NRDCSRS in soil sample ADSF-SS-4. The soil analytical results are summarized in **Table 11**.

6.6 AOC-22 – X-1908 (Clarifier Lift Sump)

A concrete lined pit, identified as X-1908 – Effluent Sump 59-195, was present in the southwest corner of the Waste Water Treatment area as depicted on **Figure 15**. The concrete pit was covered with a metal grating and was observed to contain an oily substance during the PA site inspection. An approximately 10-inch diameter hose extended down into the pit and upward toward the S-1922/S-1904/X-1903 pit (AOC-23). Another 10-inch diameter hose was connected to the side of the concrete that led to the concrete area surrounding the adsorbers and sludge drums. The Clarifier Lift Sump received input from the Sand Filter Drains (S-1927A, S-1927B, and S-1927C) and was connected to the Surge Equalization Tank (TK-1911). It should be noted that this equipment was removed during demolition activities in early 2015.

In April 2014, three (3) borings were advanced to investigate this AOC with one discrete soil sample collected from each soil boring for VO, BN, and Metals analyses. All sample results are summarized on **Table 12**. The VO analyses indicated that no compounds were detected at levels exceeding any applicable SRS. Excluding IGWSSLs, the BN analyses indicated that benzo(a)anthracene was detected above its NRDCSRS of 2 mg/kg in one sample.

Excluding IGWSSLs, the Metals analyses indicated that arsenic and antimony were detected above their respective RDCSRS of 19 mg/kg and 78 mg/kg in sample CLS-SB-3. Vanadium was detected above its NRDCSRS of 1,100 mg/kg in all samples.

6.7 AOC-23 – X-1904 (Storm Water Transfer Pump); S-1922 (Storm Water Corrugated Plate Separator); X-1903 (Storm Water Diversion Manhole)

A concrete lined pit, X-1904 – Storm Water Transfer Pump, a metal covered pit, S-1922 – Storm Water Corrugated Plate Separator, and a manhole/concrete covered pit, X-1903 – Storm Water Diversion Manhole, were observed in the northwest corner of the Waste Water Treatment area as depicted on **Figure 16**. During the Preliminary Assessment site inspections, the interior of the concrete covered pit, X-1903, and metal covered pit, S-1922, were not open for observation. The Storm Water Diversion Manhole, X-1903, received input from the tank farms and the API separator. The Storm Water Diversion Manhole, X-1903, was connected to the Storm Water Corrugated Plat Separator, S-1922, which was connected to the Storm Water Transfer Sump, X-1904. The concrete pit, X-1904, was covered with metal grating and appeared to contain an oily substance. A 10-inch diameter hose was connected to X-1908 (AOC-22) and to a steel pipe that extended into the pit. One approximately 10-inch hose and five two-inch hoses also extended into the pit.

A total of five (5) soil samples were collected from this AOC in April 2014 and analyzed for VO, BN and Metals. All sample results are summarized on **Table 13**. The VO analyses indicated that no compounds were detected above applicable RDCSRS and NRDCSRS in any sample. The BN analyses indicated that benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were detected above their applicable RDCSRS in four of the five samples.

Excluding IGWSSLs, the Metals analyses indicated that arsenic was detected above its RDCSRS of 3 mg/kg in soil samples WWTS-SB-1, WWTS-SB-2, and WWTS-SB-5, while vanadium was detected above its RDCSRS of 78 mg/kg in all samples except WWTS-SB-4.

6.8 AOC-24 – Sluice Pit

A concrete lined pit, identified as the Sluice Pit, was present in the east corner of the Aeration Basins and received water from the basins. The Sluice Pit is depicted on **Figure 17**. At the time of the PA site inspection, the pit contained standing water and staining was observed on the concrete.

Two (2) soil borings were advanced in July 2015 to investigate this AOC, designated as ABSP-SS-1 and ABSP-SS-2. A soil sample was collected from each boring at approximately 5.5 - 6.0 feet bgs, which corresponded to the base of the Sluice Pit. The samples were analyzed for EPH-Cat 2 with contingency VO, BN, PCB, and Metal analyses. All sample results are summarized on **Table 14**. Analytical results identified the presence of EPH in both samples at 68.2 mg/kg and 49.9 mg/kg, respectively, with sample ABSP-SS-1 subjected to the contingency analyses. The VO analysis indicated that no VO compounds were detected above any SRS. The BN analysis indicated that naphthalene (11.3 mg/kg) was detected above its RDCSRS of 6 mg/kg. The Metals analyses indicated that chromium was detected above 20 mg/kg in sample ABSP-SS-1, triggering a hexavalent chromium analysis. Hexavalent chromium was not detected the soil sample.

6.9 AOC-25 – X-1950A and X-1950B (Alkylation Neutralization Basin)

A multi-chamber, acid-resistant, tile-lined concrete pit was located along the east side of the Alkylation Unit, as depicted in **Figure 18**. The pit, identified as X-1950A and X-1950B, was observed to be stained during the multiple PA inspections. The pit was used to neutralize acidic and caustic liquids which were a byproduct from the Alkylation Unit process.

Eight soil borings were advanced at this AOC and a total of twelve soil samples were collected for laboratory analysis. The samples were submitted for VO, BN, Metals, pH and contingency EPH analyses. All sample analytical results are summarized on **Table 15**.

The VO analyses indicated that benzene, ethylbenzene, xylene, TBA, and trichloroethene (TCE) were detected above their applicable IGWSSL in several of the samples. The BN analyses indicated that naphthalene and 2-methylnaphthalene were detected above their RDCSRS, NRDCSRS and IGWSSL in several of the samples**.** The Metals analyses indicated that chromium was detected above 20 mg/kg in several samples, however hexavalent chromium was not identified above applicable SRS. Several metals were present in samples over their respective IGWSSL. Laboratory analysis indicated that EPH was detected at 3,520 mg/kg in soil sample AUSS-1, triggering the requirements for EPH fractionation. The fractionated EPH was entered into the EPH SRC Calculator. The results indicate that sample AU-SS-1 passed the allowable EPH SRC (**Appendix 5**).

6.10 AOC-26 – D-1104 (MEA Sump)

The Monoethanolamine (MEA) Sump was located within the center of the Fuel Gas Treating Unit, which was located southwest of the MTBE processing unit as depicted in **Figure 19**. The MEA Sump consisted of an underground flow-through tank that collected MEA from the MEA Regenerator (T-1102) and was transported to the Fuel Gas Absorber (T-1101) for reuse.

Two borings were advanced at this AOC, designated as MEA-SS-1 and MEA-SS-2, and a discrete soil sample was collected from each boring for monoethanolomine (MEA), VO, BN, and Metals analyses. All sample results are summarized on **Table 16**. The analyses indicated that no VO, BNs, or MEA were detected above their respective SRS. The Metals analyses indicated that chromium was detected above 20 mg/kg in both samples, however hexavalent chromium was not identified above its respective SRS.

6.11 AOC-27 – EADC Disposal Pit

An aboveground concrete pit was located in the northeast corner of the Dimersol Unit (AOC-18) as depicted on **Figure 20.** The pit was identified as the EADC (Ethylaluminum Dichloride) Disposal Pit and bottom staining was observed during the PA site inspection. The compound EADC was used in the refinery isomerization process (Dimersol) and is a flammable and corrosive compound that catches fire spontaneously if exposed to air. According to Mr. Joe Ragno, former Refinery Superintendent, and Mr. Bob Tulenko, former Project Design Specialist, in order to keep the EADC from contacting air while in the pit, a layer of diesel was maintained on top of the EADC. This process also allowed the EADC to slowly volatilize without reacting with oxygen.

Three borings (EADC-SS-1 through EADC-SS-3) were advanced to investigate this AOC, with a soil sample collected at 9.0 to 9.5 feet bgs from each boring for EPH, VO, BN, Metals, soil pH, and ammonia analyses. All soil sample results are summarized on **Table 17**. The analyses indicated that there were no exceedances to applicable SRS for EPH, VO or BN. The Metals analyses indicated that chromium (EADC-SS-2) was detected above 20 mg/kg, however hexavalent chromium was not identified at levels exceeding any SRS.

6.12 AOC-28 – Cooling Water Tower

A cooling water tower was located west of the API separator as shown in **Figure 21**. The concrete beneath and around the cooling water tower was observed to be stained during the PA site inspection. The cooling water

tower received waste cooling water returning from the refinery processes. The cooling water was exposed to air by cascading the water through packing material to allow waste heat to escape into the atmosphere.

A total of six borings were completed to investigate this AOC and one soil sample was collected from each boring for VO and Metals analyses. All analytical results are summarized on **Tables 18** and **19**. The VO analyses indicated that no target VO compound was detected above applicable SRS. The Metals analyses indicated that chromium was detected above 20 mg/kg, however hexavalent chromium was not detected exceeding any SRS.

6.13 AOC-30 – Sulfur Pit

A concrete pit was located along the east portion of the Sulfur Recovery Unit, as depicted in **Figure 22.** The pit was covered with a metal grate and had several pipes and hoses extending into it. The Sulfur Recovery Unit previously converted hydrogen sulfide (H2S) into liquid elemental sulfur.

Four soil borings were advanced to investigate this AOC and one soil sample was collected from each boring for VO and 2-methylnaphthalene analyses. All sample results are summarized on **Table 20**. Laboratory analyses indicated that no target compounds were detected above their respective SRS in any of the samples.

6.14 AOC-32 - X-1951 (SRU Neutralization Basin)

An acid-resistant, tile-lined concrete pit with staining was present in the central portion of the Chemical Storage Unit as depicted in **Figure 23** and identified as X-1951 – SRU Neutralization Basin. Spent acids were previously pumped into the pit, neutralized, and transferred to the API Separator (AOC-34).

Three borings were advanced to investigate this AOC and a soil sample was collected from each boring. The samples were analyzed for VO and BN. All sample results are summarized on **Table 21**. The analyses indicated that no compounds were detected above any SRS in all three samples.

6.15 AOC-33 – Truck Rack Sump 2

A concrete lined pit, identified as the Truck Rack Sump No. 2 (X-1936), was present south of the Cooling Water Tower (AOC-28) and the Truck Unloading Rack as depicted in **Figure 24**. The concrete pit was covered with metal plates and collected storm water from the catch basins at the Truck Rack. Oily water was observed within the sump during the PA site inspection.

Two soil borings (TRS2-SS-1 and TRS2-SS-2) were advanced in August 2015 to investigate this AOC and two soil samples were collected from each boring for laboratory analysis. All samples were analyzed for EPH-Cat 2, while three samples were additionally analyzed for VO and lead. All sample results are summarized on **Table 22**. Laboratory analysis did not reveal the presence of EPH concentrations above the SRS. The VO analyses indicated that benzene and TBA were detected above their respective IGWSSL in soil boring TRS2-SS-1, while no other VO compounds were identified above their respective SRS.

Soil boring TRS2-SS-1 was converted into a temporary well point. A groundwater sample (TRS2-TW-1) was also collected from a temporary well point for VO, BN, and general chemistry analyses as depicted in **Figure 25**. The BN analysis indicated the presence of benzo(a)anthracene at a concentration of 0.103 ug/l, slightly exceeding its 0.1 ug/l GWQS. The VO analysis showed elevated concentrations of PCE and its degradation products (including vinyl chloride), as well as the gasoline additive TBA. The groundwater analytical results are summarized in **Table 23**.

6.16 AOC-34 – API Separator

Several pieces of equipment were part of the API Separator located east of the Cooling Water Tower (AOC-28). The pieces of equipment included separators, sumps, and splitter box. The API Separator received process

wastewater from the former refinery, as well as storm water runoff, and conveyed it through its multiple components to remove any refinery pollutants.

The sumps were metal pits that observed to be stained during the PA site inspection. South of the API Separator was situated the API Truck Loading Area, which was used for the loading of transfer vehicles with sludge, sediment, and oil from the API Separator. The concrete within the API Truck Loading Area was observed to be stained during the PA site inspection.

A total of twelve (12) soil borings were advanced to investigate this AOC, with soil samples collected from multiple depths for VO, BN, Metals, EPH, pH, hydrogen sulfide, and ammonia analyses as depicted in **Figure 26**. All laboratory analytical results are summarized on **Tables 24** and **25**. With the exception of IGWSSL exceedances in metals, analytical data indicated that metals were not detected at concentrations that exceeded the SRS. The combined EPH analyses indicated EPH was not detected, except for sample API-SS15b, which had an EPH concentration of 13,200 mg/kg that exceeded its 1,700 mg/kg fractionation trigger concentration. However, the fractionation analysis results passed the allowable EPH SRC. The VO analyses indicated that TCE was detected above its IGWSSL of 0.01 mg/kg.

Two (2) ground water samples were collected via temporary well points at the various components of this AOC as depicted on **Figure 27**. Both samples were analyzed for VO, BN, Metals, pH, and general chemistry. The groundwater analytical results are summarized in **Table 26**.

Sample API-TW-3 was collected at the API Separator. The VO analysis indicated the presence of 1,1-Dichloroethene, MTBE, and TBA above their applicable GWQS. The BN analysis indicated the presence of bis(2-Ethylhexyl)phthalate above its 3 ug/l GWQS. The Metals analysis indicated that lead was detected above its 5 ug/l GWQS. The sample's pH reading was also above the pH GWQS.

Sample API-TW-7 was collected at the API Separator Sump. The VO analysis indicated the presence of bromodichloromethane, carbon tetrachloride, chloroform, dibromochloromethane, bromoform, and methylene chloride above their applicable GWQS. In addition, the Metals analysis indicated the presence of beryllium, chromium, nickel, and zinc above their applicable GWQS. Hydrogen sulfide and pH were also detected above their GWQS.

6.17 AOC-35 – No. 1 Landfarm Discharge Sumps

Three (3) concrete sumps covered with metal grates were present within the fenced area identified as the No. 1 Landfarm (AOC-3). The sumps served an oil/water separator associated with the No. 1 Landfarm discharge. At one time, the discharge was filtered and treated prior to discharge into the North Drainage Ditch (AOC-14), in accordance with the NJPDES Permit No. NJ0028878, Outfall No. DSN-005. Most recently, the water is pumped back into the API Separator (AOC 34) and treated through the wastewater treatment plant.

A total of four (4) soil borings, designated as 1LF-SS-1 through 1FL-SS-4, were advanced at this AOC as depicted on **Figure 28**. Two discrete soil samples were collected from each boring corresponding to the depth of the sump invert/base. Each sample was analyzed for VO, BN, PCBs, and Metals. The VO analyses indicated that benzene was detected above its IGWSSL of 0.005 mg/kg in sample ILF-SS-4A. The BN analyses indicated that benzo(a)pyrene was detected above its NRDCSRS of 0.2 mg/kg in samples ILF-SS-1A and ILFSS-3. With the exception of IGWSSL exceedances, the Metals analyses indicated that arsenic was detected in all four samples above its NRDCSRS of 19 mg/kg, while vanadium was detected above its RDCSRS of 78 mg/kg in sample ILF-SS-4A. No PCBs were detected. Soil analytical results are summarized in **Table 27**.

6.18 AOC-38 - Former Ammonia Truck Loading Rack

Equipment for the Ammonia Truck Loading Rack was located northeast of the Dimersol Unit (AOC-18), as depicted in **Figure 29**. No stains or evidence of a release of hazardous substances were observed during the PA

site inspection.

Six (6) soil borings were advanced at this AOC, designated as NH3-SS-1 through NH3-SS-6, with one soil sample collected from each boring for laboratory analysis. The samples were analyzed for EPH-Cat 2 and ammonium. Analytical data indicated that concentrations of tested compounds did not exceed applicable SRS. Sample NH3-SS-2, due to its EPH concentration of 1,060 mg/kg, was additionally analyzed for VO, BN, PCBs, and Metals. The VO, BN, and PCB analyses indicated that no results in excess of applicable SRS were detected. Excluding IGWSSL exceedances, the Metals analysis indicated that arsenic and vanadium exceeded their NRDCSRS of 19 mg/kg and RDCSRS of 78 mg/kg, respectively. Chromium was also detected above 20 mg/kg, however hexavalent chromium was not detected. The soil analytical results are summarized in **Table 28**.

6.19 AOC-40 – Fresh Acid Unloading Area

A drive-through loading/unloading area with a concrete slab, identified as the Fresh Acid Unloading Area, was located along the northwestern side of the Alkylation Unit (AOC-25) as depicted on **Figure 18**. The area was where acid and caustic liquids were transferred into tanks TK-701A and TK-701B, AOC-92, for use in the Alkylation Unit. This AOC was in close proximity to AOC-25, therefore sample data from this AOC was utilized to also assess potential impacts from this AOC-40 as well. As presented in Section 6.9, the AOC 25 analytical data indicated no impacts from AOC-40 acidic or caustic releases. The soil analytical results are presented in Table 15.

6.20 AOC-43 – Truck Unloading (Prover Truck) Area 1

The Truck Unloading Rack was located to the northeast of the Day Tankfield, as depicted on **Figure 30**. The Rack was an access point for prover trucks, which were used to test the grade of the gasoline. The gasoline was drawn into the equipment on the prover truck, tested, and then pumped back into the product line.

A total of seven (7) borings (VRUPT1-SS-1 through VRUPT1-SS-7) were advanced at this AOC, with one soil sample collected from each boring for laboratory analysis. The soil analytical results are summarized in **Table 29**. The samples were analyzed for EPH, with 25% of the samples containing EPH also analyzed for contingency VO, BN, PCBs, and Metals. The EPH analyses indicated that all seven samples contained EPH, with the concentration in sample VRUPT1-SS-7 exceeding 1,700 mg/kg. The EPH in this sample was fractionated, the results run through the EPH SRC Calculator and the findings indicate that the sample passed the allowable EPH SRC (**Appendix 5**). Since all samples were found to contain EPH, samples VRUPT1-SS-1 and VRUPT1-SS-7 (with the highest EPH concentrations) were subjected to the contingency analyses. The VO analyses indicated that benzene was detected over its NRDCSRS of 5 mg/kg in sample VRUPT1-SS-7. Ethylbenzene, methyl tert butyl ether (MTBE), and xylene were detected above their applicable IGWSSL in sample VRUPT1-SS-7. The BN analyses indicated that naphthalene was detected above its RDCSRS of 6 mg/kg in sample VRUPT1-SS-7. 2-Methylnaphthalene was detected above its IGWSSL of 8 mg/kg in sample VRUPT1-SS-7. With the exception of IGWSSL exceedances, the contingency Metals analyses indicated that chromium was detected above 20 mg/kg in both samples. However, hexavalent chromium was not detected the SRS in sample VRUPT1-SS-1, which contained the higher total chromium concentration.

6.21 AOC-44 – Truck Unloading (Prover Truck) Area 2

Six pumps with secondary concrete containment, piping, and valves with connections were located southwest of the south corner of the Second Tank Field as depicted on **Figure 31**. The valves and connections were access points for prover trucks, which were used to test the grade of gasoline. The gasoline was drawn into the equipment on the prover truck, tested, and then pumped back into the product line. Moderate staining was observed on the gravel in the vicinity of the pumps and piping during the PA site inspection.

Six borings were advanced to investigate this AOC, designated as TELP2-SS-1 through TELP2-SS-6, with one soil sample collected from each boring for laboratory analysis. The soil analytical results are presented in **Table 30**.

The samples were analyzed for EPH, VO, and lead. Contingency BN, PCBs and Metal analyses were performed for 25% of samples which contained EPH. Sample TELP2-SS-4 had the highest detected EPH result of 2,280 mg/kg, therefore the sample was also analyzed for EPH fractionation. The fractionated EPH was run through the EPH SRC Calculator with the results indicating that the sample passed the allowable EPH SRC (**Appendix 5**).

The contingency analyses were completed for samples TELP2-SS-4 and TELP2-SS-6. The BN analyses indicated that benzo(a)pyrene was detected above its NRDCSRS of 0.2 mg/kg in both samples, while naphthalene was detected above its RDCSRS of 6 mg/kg in sample TELP2-SS-4. Also, 2-methlynaphthalene was detected above its IGWSSL in sample TELP2-SS-4. The Metals analyses indicated that no metals were detected above the applicable IGWSSL in both samples.

Groundwater samples TELP2-SS-1 and TELP2-SS-4 were collected and analyzed for VO, BN and Metals. The VO analyses indicated that benzene was detected above its 1 ug/l GWQS in sample TELP2-SS-4. The Metals analyses indicated that for both samples, arsenic, beryllium, chromium, lead, and nickel were detected above the applicable GWQS. The BN analyses indicated that benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene were detected above their applicable GWQS in sample TELP2-SS-4. The sample locations are depicted on **Figure 32**, with a summary of analytical results provided in **Table 31**.

6.22 AOC-45 - Former Sulfur Recovery Unit Truck Loading Rack

A drive-through loading/unloading area with a concrete slab, identified as the SRU Truck Unloading Area, was located along the north side of the Chemical Storage Area, as depicted in **Figure 33**. Liquid elemental sulfur from the Sulfur Pit (AOC-30), located approximately 50 feet to the southwest, was transferred in this area.

Three soil borings were advanced at this AOC, designated as SRU-SS-1 through SRU-SS-3, with one soil sample collected from each boring for laboratory analysis. The soil analytical results are summarized in **Table 32**. The samples were analyzed for VO, BN, soil pH, ammonia, and sulfur, with sample SRU-SS-1 also analyzed for EPH. The EPH analysis indicated a total concentration of 792 mg/kg, while the VO analyses indicated that tested compounds did not exceed applicable GWQS. The BN analyses indicated that benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and Indeno(1,2,3-cd)pyrene were detected above their applicable NRDCSRS in sample SRU-SS-1. No other compounds were detected above their applicable SRS in any of the samples.

6.23 AOC-46 – Slop Gasoline Unloading Area

An elevated platform with convergent pipes from the southeast and southwest was identified as the Slop Gasoline Unloading Area, as depicted on **Figure 34**. Slop gasoline was gasoline that did not meet its grade criteria and had to be returned to the process stream or blended with other material. No staining or evidence of a release of hazardous substances was observed in the vicinity of the platforms and piping during the PA inspection.

Four (4) soil borings (SGTL-SS-1 through SGTL-SS-4) were advanced to investigate this AOC in September 2014 and one sample from each boring was analyzed for VO and lead. The VO analyses indicated that benzene was detected above its IGWSSL of 0.005 mg/kg in samples SGTL-SS-1 and SGTL-SS-2, while ethylbenzene was detected above its IGWSSL of 13 mg/kg in sample SGTL-SS-2. No other VO compounds or lead were detected above the applicable SRS. The soil analytical results are summarized in **Table 33**.

During the soil sampling activities, a groundwater sample (SGTL-TW-1) was collected via a temporary well point, as depicted on **Figure 35**, and was submitted for VO analysis. The VO analysis detected the BTEX suite, TCE, vinyl chloride, and carbon tetrachloride above their applicable GWQS. The Metals analysis indicated that lead was detected above its 5 ug/l GWQS. The BN analysis indicated the presence of dibromochloromethane, 1,1-dichloroethene, and methylene chloride above their applicable GWQS. The groundwater analytical results are summarized in **Table 34**.

6.24 AOC-47 - Bleach Truck Unloading Area

Two (2) small ASTs labeled as “caustic and out of service” were observed on the northeast corner of the Cooling Water Tower (AOC-28) as depicted on **Figure 36**. This AST area is identified as a Bleach Truck Unloading Area, where chemical trucks would unload caustic bleach into the ASTs for use in the Cooling Water Tower. No evidence of a release of caustic material was observed beneath the ASTs during the PA site inspection.

A soil boring, designated as API-SS-9, was installed in this area. A soil sample was collected and analyzed for VO, BN, Metals, pH, Hydrogen Sulfide, and ammonia. The samples collected from the adjacent Cooling Water Tower (AOC-28) and API Separator (AOC-34) adequately assessed the subsurface conditions also. The Cooling Water Tower and API Separator analytical findings presented in Sections 6.12 and 6.16, respectively, as well as the data from sample API-SS-9, did not indicate the presence of any impacts attributable to the use of acids or caustics. Furthermore, the VO analyses indicated tested compounds were not above the applicable SRS, except for one sample containing TCE above its IGWSSL. BN target compounds were not present above the applicable SRS and the Metal analyses indicated only vanadium above its RDCSRS of 78 mg/kg and chromium above 20 mg/kg. Hexavalent chromium was not detected above any SRS. The soil analytical results are summarized in **Table 35.**

6.25 AOC-48 - Former Equipment Fuel AST

A 1,000-gallon gasoline AST and dispenser were observed west of the ammonia area, as depicted on **Figure 37**. The AST and the dispenser were located within a concrete secondary containment structure. Staining was observed beneath the dispenser and the AST was observed to be rusted during the PA inspection.

A soil boring (EFP-SS-1) was advanced at this AOC and two samples were collected from the boring for VO analyses. Laboratory analysis of the soil samples indicated that VO compounds were not detected above the applicable standards. The soil analytical results are summarized in **Table 36**.

6.26 AOC-49 - Electrician Shop Diesel/No. 2 Fuel Oil ASTs

Four (4) No. 2 fuel oil ASTs of approximately 275-gallons each were observed to the west of the Electricians Shop located immediately north of the Administration Building as depicted in **Figure 38**. The ASTs were manifolded together and used as fuel storage for the boilers located within the Electricians Shop, providing heat for the Electricians Shop and Administration Building. The ASTs were located on a steel platform above a steel secondary containment. Staining (likely from overfilling) was observed on each of the ASTs during the PA site inspection.

One soil sample (PSRR-SS-2) was collected from this area and analyzed for EPH, PAHs, PCBs, and Metals. The Metal analysis indicated that arsenic was detected above its NRDCSRS of 19 mg/kg. The other analyses indicated that all other compounds were below applicable standards. The soil analytical results are summarized in **Table 37**.

6.27 AOC-50 - Refinery Warehouse Diesel/No. 2 Fuel Oil ASTs

A 1,000-gallon and two 275-gallon No. 2 fuel oil ASTs were present west of the Refinery Warehouse, as depicted on **Figure 39**. The ASTs were manifolded together and used as fuel storage for the boilers located within the Refinery Warehouse. The two 275-gallon ASTs were located within a steel secondary containment area, while the 1,000-gallon AST is located on a concrete slab. Staining (likely from overfilling) was observed on each of the ASTs during the PA site inspection.

A total of seven (7) soil borings (VRUPT1-SS-1 through VRUPT1-SS-7) were advanced to investigate this

AOC and one soil sample was collected from each soil boring and analyzed for EPH. The analyses indicated all concentrations were below the applicable SRS and did not require further analyses. The soil analytical results are summarized in **Table 38**.

6.28 AOC-52 - TK-7925 (Gasoline AST)

One large AST, separated into four components, was observed northwest of the Terminal Building, as depicted on **Figure 40**. The four components of the AST were labeled as "Out of Service" and two of the components of the AST were labeled as "Gasoline Cocktail". The AST is located on concrete pedestals within a shallow concrete secondary containment area. Staining was observed on the gravel along the exterior perimeter of the shallow concrete secondary containment during the PA site inspection.

A total of six (6) soil samples (TMTK-SS-1 through TMTK-SS-6) were collected from this AOC and analyzed for VO, naphthalene, 2-methylnaphthalene, and lead. Laboratory analyses did not detect any tested compounds above applicable SRS. The soil analytical results are summarized in **Table 39**.

6.29 AOC-53 – Second Tank Field

The Second Tank Field consisted of several large ASTs located in the north central portion of the property as depicted on **Figure 41**. The specific size and contents of each AST are summarized in the following table:

AST ID Number	Approximate Volume (gallons)	Contents Identified
TK-7934	6,345,000	Unleaded Premium Gasoline
TK-7935	6,345,000	Gasoline
TK-7936	9,137,000	Unleaded Gasoline
TK-7937	9,137,000	Unleaded Gasoline
TK-7938	9,137,000	Crude Oil/No. 2 Fuel Oil/Gasoline/Distillate
TK-7939	9,137,000	Russian Gas Oil
TK-7940	9,137,000	Light Cycle Oil/Distillate
TK-7941	6,345,000	Light Cycle Oil/Distillate
TK-7942	9,137,000	No. 2 Fuel Oil/Jet Fuel/Distillate/Diesel Gas

The Tank Field is surrounded by an earthen berm, within which there were several storm water catch basins, degraded concrete tank bases, and limited staining.

Twenty soil borings were performed in September 2014 and one sample was collected from each boring for laboratory analysis. Each sample was analyzed for EPH, with contingent analyses for VO, BN, and Metals. The EPH analyses indicated that two sample results were over 1,700 mg/kg and were fractionated. The fractionated EPH concentrations were run through the EPH SRC Calculator (**Appendix 5**) and passed the allowable EPH SRC. Contingency analyses were performed on samples TF-SS-1, TF-SS-3, and TF-SS-9. The VO analyses indicated that no compounds exceeded applicable SRS. The BN analyses indicated that 2-Methylnaphthalene was detected above its IGWSSL in sample TF2-SS-3. Except for naturally occurring metals, analytical data did not show the metals at levels above their applicable SRS. The soil analytical results are summarized in **Table 40**.

Groundwater sampling was performed concurrently with the soil sampling. Six samples (TF-TW-20 through TF-TW-25) were collected via temporary well points for VO, BN, Metals, and ammonia analyses, as depicted on **Figure 42**. The VO and BN analyses indicated no target compounds above applicable GWQS. The metals analyses indicated exceedances of the applicable GWQS for arsenic, beryllium, chromium, copper, lead, mercury, nickel, and zinc. The groundwater analytical results are summarized in **Table 41**.

6.30 AOC-55 – Fourth Tank Field

The Fourth Tank Field, consisting of several large ASTs surrounded by an earthen berm, was located in the eastern portion of the property as depicted on **Figure 43**. The specific size and contents of each AST are summarized in the following table:

AST ID Number	Approximate Volume (gallons)	Contents Identified
TK-1208	9,137,000	Catfeed
TK-1209	9,137,000	Catfeed
TK-1210	9,137,000	Catfeed
TK-1211	6,305,500	Unleaded Gasoline
TK-1212	6,305,500	Slurry/Gasoline

Ten (10) soil borings (TF4-SS-1 through TF4-SS-10) were completed in September 2014 and one sample was collected from each boring for laboratory analysis. All samples were analyzed for EPH and PAHs, with contingency analyses for VO, BN, and Metals. Samples that had EPH sample results over 1,700 mg/kg were fractionated. The fractionated EPH concentrations were run through the EPH SRC Calculator and all samples passed the allowable EPH SRC (**Appendix 5**).

The VO analyses indicated that benzene was detected above its IGWSSL in sample TF4-SS-9. The BN analyses indicated that benzo(a)anthracene was detected above its RDCSRS of 0.6 mg/kg in sample TF4-SS-6 and above its IGWSSL in sample TF4-SS-9. Benzo(a)pyrene was detected above its RDCSRS of 0.2 mg/kg in samples TF4-SS-1, TF4-SS-6, and TF4-SS-9. Benzo(b)fluoranthene was detected above its RDCSRS of 0.6 mg/kg in sample TF4-SS-9. With the exception of IGWSSL exceedances, the Metals analyses indicated that metals were not detected above applicable SRS. The soil analytical results are summarized in **Table 42**.

6.31 AOC-56 – Second Reserve Tank Field

The Second Reserve Tank Field, consisting of several large ASTs and surrounded by an earthen berm, is located at the extreme eastern portion of the property, as depicted on **Figure 44**. The specific size and contents of each AST are summarized in the following table:

AST ID Number	**Approximate Volume (gallons)**	**Contents Identified**
TK-1201	9,118,000	Caustics/Regular Gasoline
TK-1202	6,305,500	Gasoline
TK-1203	9,118,000	Unleaded Gasoline
TK-1204	9,118,000	No. 2 Fuel Oil
TK-1205	9,118,000	Regular Gasoline
TK-1206	9,118,000	Jet Fuel/Premium Gasoline
TK-1207	9,137,100	Gasoline
TK-1224	433,200	No. 2 Fuel Oil
TK-1225	433,200	Diesel/No. 2 Fuel Oil
TK-1226	433,200	Diesel/No. 2 Fuel Oil

TK-1227	433,200	Jet Fuel/Kerosene/Distillate
TK-1228	433,200	Jet Fuel
TK-1229	846,000	Methanol/Ethanol
TK-1230	846,000	Regular Gasoline
TK-1231	1,266,000	Ethanol
TK-1232	1,266,000	Regular Gasoline
TK-1233	Unknown	Gasoline
TK-1234	1,712,200	Gasoline/Jet Fuel/No. 2 Fuel Oil/Kerosene/Benzene
TK-1240	295,000	Distillate/RO Feed Water

Limited soil staining, storm water catch basins, and drums were observed in the AOC during the PA site inspection.

A total of forty-five (45) soil borings were completed to investigate this AOC in September 2014, with one sample collected from each soil boring for laboratory analysis. The samples were analyzed for EPH, with contingency analyses for VO, BN, and Metals. The EPH analyses indicated that several samples contained EPH concentrations above 1,700 mg/kg, which were then analyzed for EPH fractionation. The fractionated EPH concentrations were run through the EPH SRC Calculator. Samples 2RTF-SS-35 and 3RTF-SS-45 failed the allowable EPH SRC. Sample 2RTF-SS-22 contained an EPH concentration that was above its RDCSRS of 5,100 mg/kg. The soil analytical results are summarized in **Table 43**.

Contingency analyses were performed on twelve samples. The VO analyses indicated that benzene was detected above its IGWSSL of 0.005 mg/kg in four samples and chlorobenzene was above its IGWSSL in sample 2RTF-SS-35. The BN analyses indicated that 2-methylnaphthalene exceeded its IGWSSL in samples 2RTFSS-27 and 2RTF-SS-3, while benzo(a)pyrene exceeded its RDCSRS of 0.2 mg/kg in sample 2RTF-SS-42. The Metals analyses indicated that arsenic was detected above its RDCSRS of 19 mg/kg in three samples. The contingency analytical results are summarized in **Table 43**.

In October 2014, groundwater samples were collected from thirteen (13) temporary well points. The samples were submitted for VO and BN analyses, while three samples were also analyzed for Metals and ammonia. The VO analyses indicated that benzene exceeded its GWQS (1 ug/l) in eight samples, while ethylbenzene and xylene were above their GWQS in sample 2RTF-TW-17. VO TICs were detected at elevated concentrations in eleven samples. The BN analyses indicated that benzo(a)anthracene was above its GWQS (0.1 ug/l) along with BN TICs in eleven samples. There were also exceedences of benzo(a)pyrene and benzo(b)fluoranthene in several samples. The metals results from the three samples analyzed indicated GWQS exceedances in all samples. The groundwater analytical results are provided on **Figure 45** and are summarized in **Table 44**.

6.32 AOC-57 - Day Tank Field

The Day Tank Field, consisting of several large ASTs, is located in the southwest portion of the site, as depicted on **Figure 46**. The specific size and contents of each AST are summarized in the following table:

AST ID Number	Approximate Volume (gallons)	Contents Identified
TK-1101	Unknown	Petroleum Additive
TK-1102	Unknown	Xylene, Ethylbenzene, Petroleum Additive
TK-1175	Unknown	No. 2 Oil, Distillate
TK-1176	424,500	Ethanol 200 Proof, Gasoline, Benzene

TK-1177	Unknown	No. 2 Oil, Gasoline
TK-1178	211,500	No. 2 Oil, Gasoline
TK-1179	Unknown	Unleaded Premium Gasoline, Gasoline, Benzene
TK-1180	Unknown	Gasoline
TK-1181	649,700	Gasoline
TK-1182	Unknown	Diesel, Distillate

Several concrete pits beneath tank water draws were observed to be stained and contained oily water during the PA site inspection.

In October 2014, a total of twenty-two (22) borings were advanced and one soil sample was collected from each boring for laboratory analysis. Samples were analyzed for EPH, lead, and VO, with contingency 2-methylnaphthalene and naphthalene analyses. The soil analytical results are summarized in **Table 45**.

Laboratory analysis indicated that EPH was detected above its RDCSRS of 5,100 mg/kg in five samples. The VO analyses indicated that benzene was detected in 16 of the 22 samples. Benzene was detected above its 0.005 mg/kg IGWSSL in ten samples, above its RDCSRS of 2 mg/kg in three samples, and above its NRDCSRS of 5 mg/kg in three samples. The VO analyses also indicated that ethylbenzene, xylene, MTBE and TBA were detected in several samples above their respective IGWSSL. The BN analyses indicated that 2-Methylnaphthalene was detected in six samples while naphthalene was detected above its IGWSSL of 25 mg/kg in two samples and above its RDCSRS of 6 mg/kg in two samples (DTF-SS-14 and DTF-SS-20). Lead exceeded the applicable IGWSSL of 90 ug/l in two samples (DTF-SS-10 and DTF-SS-19).

Groundwater sampling occurred concurrently with the soil sampling. Six temporary well points (DTF-TW-2, DTF-TW-5, DTFTW-7, DTF-TW-14, DTF-TW-18, and DTF-TW-20) were installed and groundwater was collected from the well points and analyzed for VO and BN. The VO analyses indicated benzene and TIC exceedances in all samples, TBA exceedances in four of the samples, and exceedances of the BTEX suite in the two samples collected from the southwest portion of the tank field. The BN analyses indicated that several PAH compounds exceeded their applicable GWQS, along with all TIC concentrations in most samples. These exceedances are depicted on **Figure 47**. The groundwater analytical results are summarized in **Table 46**.

6.33 AOC-58 - Former Chemical Storage Area

The Chemical Storage Area consisted of several large ASTs in the central refinery portion of the property as depicted on **Figure 48**. The specific size and contents of each AST are summarized in the following table:

AST ID Number	Approximate Volume (gallons)	Contents Identified
TK-2601A	30,000	50 BeCaustic
TK-2601B	30,000	Spent Acid, 50 BeCaustic
TK-2602	12,600	Caustics
TK-2606	14,800	Caustics, Dilute Amine, Urcalsol Storage
TK-2607	114,300	Spent Acid
TK-2610	14,700	Spent Caustics
TK-2613	Unknown	Dimersol Spent Caustics

One soil boring was advanced in the area in July 2015 and two soil samples were collected for VO, BN, pH, ammonia, and sulfur analyses. Analytical data indicated that no tested compounds were detected above

applicable standards as summarized in **Table 47**.

6.34 AOC-59 – API Storage Area

The API Storage Area, which consists of the two ASTs (TK-7910 and TK-7911), was located southwest of the API Separator (AOC-34), and immediately southeast of the Bleach Truck Unloading Area (AOC-47), as depicted on **Figure 49**. A concrete base for a former AST was also present south of the two ASTs. The ASTs were used to store excess slop oil collected from the API Separator. The concrete slab of the API Storage Area was observed to be stained during the PA site inspection.

One soil boring (API-SS-10) was advanced adjacent to this AOC in July 2015 and two soil samples were collected for VO, BN, Metals, pH, hydrogen sulfide, and ammonia analyses. Analytical data from these samples, as well as the API Truck Loading Area samples previously summarized in Section 6.16, indicated that all target compounds were below applicable standards. The soil analytical results are summarized in **Table 48**.

6.35 AOC-60 – Avenue B Tank Field

The Avenue B Tank Field, depicted on **Figure 50**, consisted of several large ASTs located on pads and storm water catch basins. Limited gravel staining was observed during the PA site inspection. The contents of each AST are summarized in the following table:

AST ID Number	Approximate Volume (gallons)	Contents Identified
TK-7930	Unknown	Gasoline
TK-7933	Unknown	Gasoline
TK-7918	Unknown	Isobutane
TK-7919	Unknown	Butane-Butylene
TK-7920	Unknown	Butane-Butylene

Six (6) borings were advanced at this AOC, designated as ABTF-SS-1 through ABTF-SS-6, in July 2015 and one soil sample was collected from each boring for VO and lead analyses. The soil analytical results are summarized in **Table 49**. Twenty-five percent of the samples which contained detectable VOs were also analyzed for EPH. All analyses indicated that all detected compounds were below applicable SRS. VO compounds were detected, which triggered the requirement to analyze sample ABTF-SS-3 for EPH. The analysis indicated that the EPH result was over 1,700 mg/kg, therefore the sample was fractionated. The fractionated EPH concentrations were run through the EPH SRC Calculator with the results passing the allowable EPH SRC (**Appendix 5**).

6.36 AOC-62 – Inactive Railroad Spur (Between Canning Plant and QC Lab)

A review of the historic aerial photographs identified the presence of a railroad spur west of the Former Canning Plant (AOC-101) between 1966 (at earliest) and 1980. The inactive rail spur extends from the existing Conrail tracks to the location of the Former Canning Plant, suggesting it served the building. This AOC is depicted on **Figure 51**.

Five (5) borings, designated as CPRR-SS-1 through CPRR-SS-5, were advanced along this linear AOC in July 2015 as depicted on **Figure 51**. A soil sample was collected from each boring for EPH, PAHs, PCBs, and Metal analyses, while samples CPRR-SS-1 and CPRR-SS-2 were additionally analyzed for VOs and BNs. The PAH analyses indicated that there were exceedances of the RDCSRS for indeno(1,2,3-cd)pyrene, benzo(a)pyrene

and benzo(b)fluoranthene and of the IGWSSL for benzo(a)anthracene in sample CPRR-SS-2. The Metals analyses, excluding IGWSSL exceedances, indicated that no metal was detected above its SRS. The analytical results indicated no SRS exceedances for EPH, VO, or BN compounds. The soil analytical results are summarized in **Table 50**.

6.37 AOC-63 - Former Rail Lines (Vacant Land North)

Based on a review of the historic aerial photographs and USGS 7.5 Minute Topographic Maps, multiple railroad tracks identified as the Lehigh Valley (Perth Amboy Branch) existed along and within the northeast corner of the property between 1898 and 1966. Subsequently, the area became vegetated (which is the current state) with the presence of surface debris. AOC-63 is depicted on **Figure 52**.

Thirty-one (31) soil borings, designated as VLRR-SS-1 to VLRR-SS-31, were advanced and soil samples were collected to investigate this AOC in August 2014. All samples were analyzed for BN, PCBs, and Metals, while sample VLRR-SS-29 was also analyzed for pesticides. The PAH analyses indicated that benzo(a)pyrene was detected above its RDCSRS of 0.2 mg/kg in five samples and benzo(b)fluoranthene was detected above its RDCSRS of 0.6 mg/kg in three samples. The PCB analyses indicated that Arochlor 1254 was detected above the total PCB RDCSRS of 0.2 mg/kg in sample VLRR-SS-26. With the exception of IGWSSL exceedances, the Metals analyses indicated arsenic was detected above its RDCSRS of 19 mg/kg in four samples. The soil analytical results are summarized in **Tables 51** and **52**.

6.38 AOC-64 – Inactive Railroad Spur (Administration Building)

Based on the review of the historic aerial photographs, a railroad spur extended from the current Conrail railroad tracks that trend north-to-south through the western portion of the Site. The spur extended toward the Administration Building, identified on **Figure 53**, from at least 1947 to 1957. During this time period, the Administration Building was owned and occupied by the Petroleum Solvents Corporation. No evidence of the rail spur exists today.

Five (5) soil borings (PSRR-SS-1 through PSRR-SS-5) were advanced to investigate this AOC in July 2015. One soil sample was collected from each boring for EPH, PAH, PCBs, and Metals analyses. Additionally, soil samples from borings PSRR-SS-2 and PSRR-SS-4 were analyzed for VO, BN, naphthalene, and 2-methylnaphthalene. The EPH analyses indicated that an EPH concentration was detected in sample PSRR-SS-4 above 1,700 mg/kg which required EPH fractionation. The fractionated EPH was run through the EPH SRC Calculator with the results passing the allowable EPH SRC as shown in **Appendix 5**. The Metals analyses indicated that mercury was detected in samples PSRR-SS-2 and PSRR-SS-5 and arsenic was detected above its NRDCSRS of 19 mg/kg in PSRR-SS-2. Chromium was detected in sample PSRR-SS-5 above 20 mg/kg, however hexavalent chromium was not detected above any applicable standards.

The PAH and PCB analyses indicated that no compounds were detected above applicable SRS. The VO analyses indicated that the IGWSSL was exceeded in sample PSRR-SS-4 for chlorobenzene, 1,2-dibromoethane, 1,2- dichlorobenzene, ethylbenzene, toluene, and xylene. The VO compounds 1,4-Dichlorobenzene, and 1,2,4- trichlorobenzene were detected above their applicable NRDCSRS in sample PSRR-SS-4. The BN analyses indicated that no compounds were detected above their applicable SRS. The soil analytical results are summarized in **Table 53**.

6.39 AOC-73 – TEL Building (North)

The TEL Building (North) was the location where tetraethyl lead (TEL) was manufactured by adding ethyl chloride to a powdered alloy of lead and sodium, which resulted in a dense, colorless liquid that was highly volatile. TEL was used as an anti-knock gasoline additive which was phased out in the 1970s. The building formerly existed northeast of Tank TK-7942 (between 1970 and 1986) at the location identified on **Figure 54**. The small square

building had an associated small oval-shaped structure and piping that connected the building with the Second Tank Field.

Three (3) soil borings were advanced to investigate this AOC, designated as TEL1-SS-2, TEL1-SS-3 and TEL1-SS4, in September 2014. One soil sample was collected from each soil boring for VO and lead analyses. The analyses indicated that tested compounds did not exceed applicable standards. The soil analytical results are summarized in **Table 54**.

6.40 AOC-74 – TEL Building (South)

The TEL Building (South) housed the same manufacturing function of the TEL Building (North). The TEL Building (South) formerly existed (between 1963 and 1979) between the Second and the Third Tank Fields, south of the Second Tank Field's tank TK-7934 and immediately west of the former Truck Unloading Area 2 (AOC-44) as depicted on **Figure 31.** There was no evidence of the former building's presence during the PA site inspection.

This AOC is situated adjacent to the Truck Unloading (Prover Truck) Area 2 (AOC-44) and samples associated with AOC-44 can also serve to assess AOC-74. The AOC-44 sample analyses, summarized in Section 6.21, did not indicate a detection of VO or lead compounds above any applicable SRS. The laboratory data is summarized in **Table 30**.

6.41 AOC-75 – Former Canning Plant AST

The Former Canning Plant was located in the southwest portion of the property as identified in **Figure 55** and included a tank field consisting of three large ASTs and four smaller ASTs located west of the building. The building's operations consisted of canning various motor oils into aluminum and tin cans and it is assumed that the ASTs stored the various motor oils for canning.

Six (6) borings (CPTF-SS-1 through CPTF-SS-6) were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring for laboratory analysis. All samples were analyzed for EPH with contingency VO, BN, PCBs, and Metals analyses. The EPH analyses indicated that EPH was detected in samples CPTF-SS-1, CPTF-SS-5, and CPTF-SS-6. Contingency analyses were performed on sample CPTF-SS-1, which showed an EPH concentration of 3,500 mg/kg. The contingency analyses indicated that tested compounds were not detected above applicable SRS. The soil analytical results are summarized in **Table 55**.

6.42 AOC-77 – Former Petroleum Solvents AST

A former tank field consisting of six ASTs bordered by a raised berm was located south of the Administration Building (AOC-11a) between 1947 and 1957. The Administration Building was previously owned and occupied by the Petroleum Solvents Corporation during this time period. It is unknown what products would have been stored within the former ASTs. This AOC is depicted on **Figure 56**.

Three (3) soil borings (PSTF-SS-1 through PSTF-SS-3) were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring for EPH and contingency VO, BN, PCBs, and Metals analyses. Laboratory analysis indicated that EPH was detected in samples PSTF-SS-1 and PSTF-SS-3, with the contingency analyses performed on sample PSTF-SS-1 (502 mg/kg). VO analysis indicated that chlorobenzene, 1,2-dichlorobenzene, cis-1,2-dichloroethene, ethylbenzene, and xylenes exceeded their respective IGWSSL. The VO compounds 1,4-dichlorobenzene (71.5 mg/kg) and tetrachloroethene (1,590 mg/kg) were detected above their applicable NRDCSRS of 13 mg/kg and 5 mg/kg, respectively. The VO analysis also indicated that 1,2,4-trichlorobenzene (250 mg/kg) and trichloroethene (10.2 mg/kg) were detected above their applicable RDCSRS in sample PSTF-SS-1. The Metals analysis indicated that chromium was detected above 20 mg/kg, however the hexavalent chromium analysis revealed no exceedance of applicable standards. All other contingency analyses indicated that all tested compounds were below applicable standards. The soil analytical results are summarized

in **Table 56**.

6.43 AOC-80 – Former Crude Topping Unit

The Hydrodesulfurization (HDS) Unit and Hydrogen Unit were located north of API Unit (AOC-34) and west of the Rundown Tankfield (AOC-14b), as depicted in **Figure 57**. The HDS Unit was a catalytic chemical process used to remove sulfur from natural gas and refined petroleum products (gasoline, jet fuel, kerosene, and diesel fuel). The HDS Unit and Hydrogen Unit were components of the Crude Topping Unit, which consisted of atmospheric distillation units that produced hydrocarbon boiling point cuts ranging from residue to Liquefied Petroleum Gas (LPG). Asphalt production with vacuum distillation and air blowing from the residue was also possible with the equipment. Staining was observed on the concrete base of several pieces of HDS equipment during the PA site inspection.

Six (6) soil borings (CTU-SS-1 through CTU-SS-6) were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring location for EPH, VO, BN, and Metals analyses. Laboratory analysis indicated that EPH was detected at a concentration above 1,700 mg/kg in sample CTU-SS-2, therefore the sample was fractionated. The fractionated EPH concentrations were run through the EPH SRC Calculator and the results indicated that it failed the allowable EPH SRC as documented in **Appendix 5**. The VO analyses indicated that chlorobenzene was detected above its IGWSSL in sample CTU-SS-2 while the BN analyses indicated that 2-methylnaphthalene was detected above its IGWSSL in samples CTU-SS-2 and CTU-SS-6. With the exception of IGWSSL exceedances, the Metals analyses indicated that all metals were detected below applicable SRS. The soil analytical results are summarized in **Table 57**.

One groundwater sample (CTU-SS-2) was collected from a temporary well point concurrently with the soil sampling event and submitted for VO and Metals analyses. The VO analysis indicated the presence of chlorobenzene at 138 ug/l, which exceeded its GWQS of 50 ug/l. The Metals analysis indicated the presence of arsenic at 4.4 ug/l, which exceeded its GWQS of 3 ug/l. The sample location and analytical data is depicted on **Figure 58**. The groundwater analytical results are summarized on **Table 58**.

6.44 AOC-82 – Former Incinerator Building

Between 1979 and 1995, a former Incinerator Building was located east of the Day Tank Field (AOC-57) and southeast of the Truck Rack Vapor Recovery Unit (VRU) (AOC-86), as depicted on **Figure 30**. The nearby Truck Unloading Area 1 (AOC-43) had site investigation activities conducted as summarized in **Section 6.20**. The sampling evaluated soil conditions at the former Incinerator Building, as well as at the Truck Rack VRU. The AOC-43 analytical results identified gasoline components and several metals exceeding their applicable IGWSSL. The soil analytical results are summarized in **Table 29**.

6.45 AOC-84 – Former Tank North of Administration Building

A 1957 topographic map depicted one AST north of the Administration Building (AOC-11a), as depicted on **Figure 59**. The building was previously owned by the Petroleum Solvents Corporation. A soil sample (PSRR-SS-1) was collected in the vicinity of this AOC in July 2015 for EPH, PAH, PCBs, and Metals analyses. Laboratory analysis indicated that no compounds exceeded the applicable SRS and the data is summarized in **Table 59**.

6.46 AOC-85 - Marine VRU/TK-4701 and TK-4801

Equipment for the Marine VRU was located southeast of the Guard Tower as depicted on **Figure 60**. The Marine VRU separates and recovers olefins using various filters, two tanks (TK-4701 and TK4801), four absorbers (D-4701A, D-4701B, D-4801A, and D-4801B), three exchangers (E-4601, E-4701, and E4801), two blowers (B-4601A and B-4601B), and several compressed nitrogen canisters. Tank TK-4701 was labeled as “benzene” and Tank TK-4801 was labeled as “gasoline”.

Six (6) soil borings (MVRU-SS-1 to MVRU-SS-6) were advanced to investigate this AOC and one soil sample was collected from each boring for EPH and VO analyses, with contingency BN analyses. The VO analyses indicated that no tested compounds were detected above the applicable SRS. Laboratory analysis indicated the presence of EPH in all six soil samples, with the highest concentrations in samples MVRU-SS-5 (405 mg/kg) and MVRU-SS-4 (3,010 mg/kg). These samples were therefore subjected to contingency BN analyses. The BN analyses indicated that benzo(a)anthracene and benzo(b)fluoranthene exceeded the NRDCSRS in sample MVRU-SS-4. Benzo(a)pyrene was detected above its RDCSRS in samples MVRU-SS-4 and MVRU-SS-5. Dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene were detected in excess of their respective RDCSRS in sample MVRU-SS-4. The soil analytical results are summarized in **Table 60**.

6.47 AOC-86 – Truck Rack Vapor Recovery Unit

The Truck Rack VRU was located north of the former Incinerator Building (AOC-82), and adjacent to the Truck Unloading (Prover Truck) Area 1 (AOC-43), as depicted on **Figure 30**. The VRU separated and recovered olefins by utilizing equipment which included a Knockout Drum (D-4403), Separator, Seal Pump, Return Pump, and Carbon Bed A and Carbon Bed B (D-4401A and D-4401B). The equipment had associated containers of chemicals which were stored above a metal secondary containment system. A small amount of red colored liquid was observed in the containment area when inspected. The close proximity of the VRU to AOC-43 allowed for the AOC-43 soil samples to be utilized to provide data on the soil conditions for this area as well. The AOC-43 data identified gasoline components and several metals exceeding their applicable IGWSSL. The soil analytical results are summarized in **Table 29**.

6.48 AOC-87 – Flare Knock Out Drum

A Flare Knock Out Drum existed southeast of the Rundown Tank Field (AOC-14b) and southwest of the SLF (AOC-2), as depicted on **Figure 61**. The Drum was a large tank-like structure with piping mounted on concrete supports which functioned as a vapor liquid separator. Ponded water and slight staining was observed on the gravel in the vicinity of the Drum during the PA site inspection.

Two (2) soil borings (FKD-SS-1 and FKD-SS-2) were advanced in September 2015 to investigate this AOC and one soil sample was collected from each boring for laboratory analysis. The samples were analyzed for EPH, with contingency analyses conducted on sample FKD-SS-1 for VO, BN, PCBs, and Metals due to its higher EPH concentration of 93.6 mg/kg. With the exception of IGWSSL exceedances, all laboratory analyses indicated that tested compounds did not exceed the applicable SRS. The soil analytical results are summarized in **Table 61**.

6.49 AOC-88 – Compressor Building

Four (4) liquid petroleum gas-fueled air compressors (C-601, C-602, C-603, C-701) were present on the second floor of a building located south of the alkylation unit, as identified on **Figure 62**. Staining was observed on the concrete slab of the first floor, beneath the air compressors, during the PA site inspection.

Two (2) soil borings (CB-SS-1 and CB-SS-2) were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring for EPH analysis, with contingency VO, BN, PCBs, and Metals analyses. Laboratory analysis indicated that EPH was detected at a concentration above 1,700 mg/kg in both samples, requiring EPH fractionation. The fractionated EPH concentrations were run through the EPH SRC Calculator, with both samples exceeding the allowable EPHC SRC (**Appendix 5)**.

The EPH concentration of 62,500 mg/kg in sample CB-SS-2 was subjected to the contingency analyses. The VO analysis indicated that benzene was detected above its applicable IGWSSL. The BN analyses indicated that naphthalene and 2-methylnaphthalene were detected above their applicable IGWSSL and benzo(a)anthracene was detected above its RDCSRS of 0.6 mg/kg. With the exception of IGWSSL exceedances, no metals were detected above their applicable SRS. The soil analytical results are summarized in **Table 62**.

6.50 AOC-89 – Cracking Tower

There was a Fluidized-bed Catalytic Cracking (FCC) Unit, also identified as the Cracking Tower, located west of the Avenue D Tankfield (AOC-60), as identified in **Figure 63**. The Cracking Tower consisted of a Main Column (T-501), Reactor (R-501), Regenerator (R-502), Fresh Catalyst Hopper (D-501), Spent Catalyst Hopper (D-502), Light Cycle Oil Stripper (T-502), and HCN Stripper (T-503). The Cracking Tower performed catalytic cracking to refine a hydrocarbon liquid into petroleum products. The equipment, piping, and concrete slab throughout the entire FCC Unit were observed to be stained during the PA site inspection.

Four (4) soil borings (FCC-SS-1 through FCC-SS-4) were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring for laboratory analysis. The samples were analyzed for VO, BN, PCBs, Metals, and general chemistry parameters. The VO analyses indicated the presence of benzene, xylene and naphthalene in samples FCCSS-1 and FCC-SS-4 at concentrations above their respective IGWSSL. In soil sample FCC-SS-4, BN analysis indicated that dibenzo(a,h)anthracene, benzo(a)anthracene, and benzo(a)pyrene were detected above their applicable NRDCSRS and benzo(b)fluoranthene and 2-methylnaphthalene was detected above their applicable RDCSRS. Metals analyses indicated that antimony, arsenic, beryllium, cadmium, lead, mercury, nickel, vanadium, and zinc were detected above their applicable IGWSSL in sample FCC-SS-2. Chromium was also detected above 20 mg/kg in samples FCC-SS-2, FCC-SS-3 and FCC-SS-4R. The samples were subsequently analyzed for hexavalent chromium and laboratory results indicated that levels were all below the applicable SRS. The soil analytical results are summarized in **Table 63**.

6.51 AOC-90 – Drum Compound (QC Lot)

A former rectangular drum storage area was present in the southwest corner of the property as identified on **Figure 64**. Two borings, DSQC-SS-1 and DSQC-SS-2, were advanced to collect one soil sample from each boring for EPH, VO, BN, PCBs, and Metals analyses. All analyses indicated that metals were the only contaminant suite detected with concentrations above SRSs. In soil sample DSQC-SS-1, chromium was detected above 20 mg/kg. Subsequent hexavalent chromium laboratory analysis did not detect the presence of this metal. The soil analytical results are summarized in **Table 64**.

6.52 AOC-92 – TK-701A and T-701B

A former rectangular drum storage area was located between the Alkylation Neutralization Basin (AOC-25) and the Fresh Acid Unloading Area (AOC-40) and is depicted on **Figure 18**. Eight (8) soil borings were installed to investigate AOC-25, which is in the vicinity of AOC-92, and were deemed to be adequate to evaluate soil conditions at AOC-92 as well. As summarized in **Section 6.9**, soil samples were submitted for VO, BN, Metals, pH and contingency EPH analyses.

The VO analyses indicated the presence of benzene, ethylbenzene, xylene, TBA, and trichloroethene (TCE) above their applicable IGWSSL in the samples. The BN analyses indicated that naphthalene and 2-methylnaphthalene were detected above their RDCSRS**,** NRDCSRS, and IGWSSL in all samples. The Metals analyses indicated that chromium was detected above 20 mg/kg in several samples, however no hexavalent chromium was identified above the applicable SRS. EPH was detected at a concentration of 3,520 mg/kg in soil sample AU-SS-1, triggering the requirements for EPH fractionation. The fractionated EPH was entered into the EPH SRC Calculator and the results indicate that sample AU-SS-1 passed the allowable EPH SRC (**Appendix 5**). The soil analytical results are summarized in **Table 15**.

6.53 AOC-96 – Boiler Area

Two boilers (B-2503 and B-2504) were present between the Cooling Water Tower (AOC-28) and the electrical sub-station, as depicted on **Figure 65**. Staining, oily residue, and containers of chemicals were observed to be present on the concrete slab in the area around the boilers during the PA site inspection.

Four (4) soil borings, designated as BA-SS-1 through BA-SS-4, were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring for VO, BN, Metals, and general chemistry analyses. Laboratory analyses indicated that metals were the only contaminant suite detected, with concentrations above the applicable SRS. Chromium was present in the three samples (BA-SS-1, BA-SS-3, and BA-SS-4) above 20 mg/kg, with the subsequent hexavalent chromium analyses indicating a concentration of 4.9 mg/kg in sample BA-SS-1. The soil analytical results are summarized in **Table 65**.

6.54 AOC-99 – Chemical Storage Adjacent to Cooling Water Tower

A concrete containment area, located between the Cooling Water Tower (AOC-28) and the Bleach Truck Unloading Area (AOC-47), was utilized to store sulfuric acid for the Cooling Water Tower. The chemical storage area is depicted on **Figure 66.** No staining or evidence of a release of hazardous substances was observed during the PA site inspection.

A soil boring (API-SS-11/12) was advanced in the vicinity of this AOC in August 2015 and two soil samples were collected from this boring and analyzed for VO, BN, Metals, and general chemistry parameters. All analyses indicated that no contaminant suite was detected with concentrations above their respective IGWSSL as summarized in **Table 66**.

The soil boring was subsequently converted into a temporary well point. A groundwater sample was collected and analyzed for VO, Metals, and general chemistry parameters. The VO analysis indicated the presence of the primary and degradation compounds of the CVOC suite, including PCE, TCE, 1,1-Dichloroethene, 1,2-Dichloropropane, and vinyl chloride above their applicable GWQS. The Metals analyses showed several metals at concentrations above the applicable GWQS as summarized in **Table 67**.

6.55 AOC-100 – Laydown Yard

A large asphalt-surfaced, fenced storage area known as the Laydown Yard is located in the eastern portion of the property, immediately west of the Marine VRU (AOC-85), as identified in **Figure 69**. The Laydown Yard stores equipment such as cable, snow plows, empty chemical containers, and spare pumps, parts, and piping. No staining or evidence of a release of hazardous substances was observed on the asphalt during the PA site inspection, however, sampling was performed within the Laydown Yard to access former Fire Pits, AOC-103, historically located within the Yard. A summary of the sampling results is presented in **Section 6.57.**

6.56 AOC-102 – Vacant Land (South)

A large portion of vacant land lies within the northern portion of the property. Based on a review of the historic aerial photographs, the portion of the vacant land north of the North Drainage Ditch, AOC-104, and south of the Former Rail Lines (Vacant Land North), AOC-63, was undeveloped marsh land prior to 1954 when the placement of fill material was evident as recent as 1980. Numerous pieces of equipment, vehicles, and storage containers were evident between 1986 and 1995. The area is currently vacant, vegetated with grasses and small trees and covered with scattered debris such as wood boards, gravel, tires, metal, concrete, and plastic.

A total of three (3) soil borings, designated as VLLD-SS-1 to VLLD-SS-3, were advanced in August 2014, as identified on **Figure 68**. One soil sample was collected from each boring for VO, BN, pesticides, PCBs, and Metals analyses. The BN analyses indicated that benzo(a)pyrene was detected above its RDCSRS of 0.2 mg/kg in sample BLLD-SS-3. The PCB analyses indicated that Arochlor 1248 and Arochlor 1254 were detected above the total PCB NRDCSRS and RDCSRS, respectively, in sample BLLD-SS-3. The Metals analyses indicated that arsenic and vanadium were detected above their applicable RDCSRS in sample BLLD-SS-3. The soil analytical results are summarized in **Table 68**.

6.57 AOC-103 - Fire Pits/Fire Areas

Historic aerial photographs documented four dark depressions between 1969 (at earliest) and 1980 within the Laydown Yard (AOC-100). According to the former Hess Fire Chief, Mr. Rich Bonner, and the former Hess Environmental Health and Safety Specialist, Mr. Howard Goldman, the depressions were Fire Pits that were used for training of the fire and safety personnel. Fires were set using different accelerants to determine what fire suppressant foams should be used.

A total of fourteen (14) soil borings were advanced in August 2014 to investigate this AOC at locations identified on **Figure 69**. One soil sample was collected from each boring for EPH-Cat 2 and contingency VO, BN, PCBs, and Metals analyses. Laboratory analysis indicated that EPH was detected above its RDCSRS of 5,100 mg/kg in samples FP-SS-6 and FP-SS-10. EPH fractionation was performed on sample FP-SS-11, with the fractionated EPH concentrations run through the EPH SRC Calculator and passing the allowable EPH SRC. The EPH SRC Calculator data is provided in **Appendix 5**.

Contingency analyses were performed on 7 of the 14 samples as summarized in **Table 69**. The BN analyses indicated that RDCSRS exceedances were identified in sample FP-SS-1 for benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene . The Metals analyses, with the exception of IGWSSL exceedances, indicated that arsenic was detected above its NRDCSRS of 19 mg/kg in sample FP-SS-1.

6.58 AOC-107 – Drum Storage Compound

Two fenced-in storage areas were present north of the Refinery Warehouse and are depicted on **Figure 70**. The areas have stored, since the 1980's, steel and plastic 55-gallon drums and various size totes containing various chemical compounds. Most of the drums were stored on wood pallets, with several stored directly on the concrete slab. During the PA site inspection, the drums and totes were observed to be in good condition, with the exception of a few drums that were heavily rusted with associated staining of the underlying concrete slab beneath the drums.

Five (5) soil borings (DCW-SS-1 through DCW-SS-5) were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring location for laboratory analysis. The samples were analyzed for EPH Cat 2, VO, BN, Metals, and general chemistry. Two of the samples were also submitted for PCB analyses. All analyses indicated that metals were the only contaminant suite detected with concentrations above the applicable SRS. The Metals analyses indicated that chromium was detected above 20 mg/kg in samples DCW-SS-1, DCW-SS-2, DCW-SS-3 and DCW-SS-5, with the subsequent hexavalent chromium analyses indicating no exceedances. The data is summarized in **Table 70**.

6.59 AOC-116 - Diesel Powered Emergency Generator – South Dock

One diesel powered emergency generator and associated AST on a concrete slab were present at the Marine Terminal Loading Rack Area (AOC-16b) as depicted on **Figure 71**. Staining was present on the concrete around the supply and return piping running along the base of the generator as observed during the PA site inspection.

Four (4) soil borings (DPG1-SS-1 through DPG1-SS-4) were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring for EPH-Cat 2 analyses. Laboratory analysis indicated that EPH was detected at maximum of 124 mg/kg (sample DPG1-SS-1), which is also below the EPH trigger concentration for contingency analysis. The data is summarized in **Table 71**.

6.60 AOC-117 - Diesel Powered Emergency Generator – Millwright's Shop

One diesel powered emergency generator and associated AST on a concrete slab were present east of the Millwright's Shop, as depicted on **Figure 72**. Staining was observed on the concrete around the base of the generator during the PA site inspection.

Four (4) soil borings (DPG2-SS-1 through DPG2-SS-4) were advanced in July 2015 to investigate this AOC and one soil sample was collected from each boring for EPH-Cat 2 analyses. Laboratory analysis indicated that EPH was not detected in any samples above the EPH trigger concentration for contingency analysis as summarized in **Table 72**.

7.0 GROUNDWATER INVESTIGATION

Groundwater sampling activities were part of the Site Investigation of select AOCs. Groundwater analytical data from 2014 sampling of temporary well points and existing monitoring wells were reviewed and, where necessary, additional groundwater samples were collected from temporary well points that were installed between July and August 2015. Temporary well construction logs are available in **Appendix 2**. Groundwater samples were collecting using NJDEP-approved low flow sampling techniques. All results were compared to the NJDEP's Ground Water Quality Standards (GWQS). In general, the AOC-specific groundwater sampling that was performed in 2014 and 2015 has been summarized in the appropriate AOC sections in the preceding Section 6 and will not be presented in this section.

7.1 Historic Groundwater Sampling

Groundwater sampling has been performed on a quarterly basis at historic AOCs. Some of the sampling was initiated in 2002 in association with NJDEP permitting requirements. Specifically, the groundwater monitoring has been focused on wells within the North Landfarm (AOC-1), the South Landfarm (AOC-2), and the No. 1 Landfarm (AOC-3). The following sections summarize the groundwater trends that have been documented at these three AOCs. The summaries will refer to the Semi-Annual Groundwater Monitoring Reports that have been submitted to the USEPA and the NJDEP since the inception of the property's NJDEP ISRA case. The cited reports are presented in **Appendix 2**.

7.1.1 North Landfarm (NLF), AOC-1

As presented in Section 5.1, the NLF is a land treatment system located along the central northeast property boundary, encompassing approximately one-third of an acre, which was constructed in 1974 and operated from 1975 to 1988. The NLF was permitted under NJPDES Discharge to Groundwater Permit No. NJ0028878 to treat RCRA hazardous waste and during its operational period received approximately 21 tons of hazardous waste. The NLF was identified as a SWMU during a 1986 RCRA Facility Assessment (RFA) conducted by the USEPA under the RCRA Corrective Action Program. On April 18, 1988, investigative and remedial requirements for the NLF were incorporated into the facility's HSWA Permit No. NJD045445483 by the USEPA in 1988. Subsequently, the USEPA's Bureau of Federal Case Management (BFCM) assumed oversight of the NLF in November 1995.

Sampling has been performed via seven monitoring wells, LN-1 through LN-7, around the exterior perimeter of the NLF. The sample parameters for the operating permit have been VOs, Metals, pesticides, radioactivity, and general chemistry. The quarterly sampling has documented consistent groundwater conditions with no elevated VO, pesticide, or radioactive compounds. Parameters above NJDEP Standards have included several metals and geochemistry categories.

7.1.2 South Landfarm (SLF), AOC-2

As presented in Section 5.2, the SLF was constructed in 1975 above a former surface impoundment that received oily wastewaters and operated until 1984. Hess requested initial closure of this Landfarm in May 1984, after it was determined that it may not meet the RCRA land treatment regulation requiring a minimum of three feet of soil between the bottom of the treatment zone and the top of the seasonally high water table. Hess submitted a Revised RCRA Closure Plan and a NJDPDES Permit Application in 2006. Quarterly groundwater monitoring continues to be performed until closure of the landfarm is completed.

Sampling has been performed via four monitoring wells, LS-1R through LS-4, around the exterior perimeter of the SLF. The sample parameters for the operating permit have been VOs, Metals, and general chemistry. The quarterly sampling has documented consistent groundwater conditions with elevated parameters above NJDEP Standards including benzene (present in wells LS-3 and LS-4), several metals, and geochemistry categories.

7.1.3 No. 1 Landfarm

The No. 1 Landfarm is an approximately 170,000 square foot basin that was constructed in 1985 with a leachate collection system and underlying compacted clay liner. NJDPES Permit No. NJG0225720 was issued by the NJDEP in 2013 for the discharge of treated leachate to the Arthur Kill via the North Drainage Ditch. The department determined that the discharge constituents met the eligibility criteria for the General Petroleum Product Cleanup Permit.

Sampling of the groundwater has been performed via six monitoring wells, L1-1 through L1-4, BG-2 and BG-3, around the exterior perimeter of the Landfarm. Soil-pore liquids in the vadose zone have been monitored via two lysimeters and one leachate sample is collected from the treatment system. The sample parameters for the operating permit have been the Priority Pollutant List (PP+40) excluding PCBs and pesticides, and general chemistry. The quarterly sampling has documented consistent groundwater conditions with no elevated VO or BN compounds in the groundwater, pore liquids, or leachate. Metals were consistently below NJDEP Standards, with the exception of arsenic and lead in groundwater, lead in a pore liquid sample, and arsenic and nickel in the leachate.

7.2 Potential Groundwater Contaminant Sources

The historical groundwater sampling dataset for the site is large due to the number of AOCs, the duration and frequency of historical monitoring, and the number of parameters analyzed for any given sample. Although a groundwater sample is collected to investigate or monitor conditions at a target AOC, for the most part any NJDEP GWQS exceedance cannot necessarily be attributed to that AOC. The following sections summarize site-wide overviews of the detected contaminants in the groundwater, as well as compounds detected in the soil at concentrations above their applicable IGWSSL.

7.2.1 Historic Fill Material

As presented in **Section 3.1,** the property was developed with the placement of anthopogenically impacted soil (originating from off-site locations) upon topographically lower land, which was primarily wetlands. The source locations are for the most part unknown, although dredged material from the adjacent Arthur Kill Shipping Channel has been historically placed upon the site. The NJDEP has acknowledged the introduction of off-site materials onto the site in its state database.

The NJDEP has recognized and acknowledged that two contaminant suites are inherent with historic fill material. The suites are metals and base neutrals, especially its sub-set PAHs. It has been cited in the introduction to **Section 6** that much of the historic soil and groundwater sampling has documented a presence of metals and PAHs, in many instances at levels above applicable SRS and GWQS. With the exception of the lead, the other metals that have been detected are not attributed to past on-site operations and are likely associated with the underlying historic fill material (arsenic, lead, mercury).

To a lesser extent, BN and PAHs have been detected site-wide, with particular sampling locations also having concentrations above applicable SRS and GWQS. Although associated with historic fill material, it is recognized that the BN and PAH occurrences could also be associated with on-site operations. Evidence that suggests a fill material origin for elevated the BN and PAH levels includes the non near-surface depths of the elevated concentrations, the lack of a vertical contaminant pathway, and the sample's collection from the documented fill material stratum, all of which are documented in the soil logs. Further supporting evidence is the random occurrence of PCB compounds with the metals and/or BN compounds at non-electrical operations locations. An example of fill material contaminants is evidenced by the soil and groundwater sampling data associated with the former vacant rail lines (Vacant Land North/AOC-63). This area was developed to accommodate railroad use for the adjacent off-

site Coal Docks and was never utilized by Hess for its operations.

7.2.2 Chlorinated VO Compounds

Chlorinated VO Compounds (CVOCs) have been detected in the soil and groundwater beneath the site. There is one major and one minor CVOC occurrence beneath the site. The major occurrence is associated with the former Administration Building (AOC-11a). The building has a pre-Hess origin and was formerly occupied by the Petroleum Solvents Corporation between 1947 and 1957. The building had documented associate components during the same time period, a railroad siding (AOC-64) and ASTs (AOC 77).

Soil and groundwater sampling has documented a CVOC occurrence with the highest concentrations at the Administration Building. The CVOC suite ranges from the primary compound PCE through the complete ethene transformation pathway to vinyl chloride. The contaminant footprint trends southward beneath the Detention Basin (AOC-12) and almost to the southern property line. A secondary CVOC suite associated with the Administration Building is the primary compound 1,1,1-trichloroethane (TCA) through its complete ethane transformation pathway to chloroethane. The TCA contaminant footprint is different than the PCE footprint. The TCA occurrence is situated on the west and north sides of the Administration Building, with the TCA GWQS exceedance (30 ug/l) footprint extending northward toward the property line.

A minor CVOC occurrence has been documented in the eastern portion of the site beneath the Fourth Tankfield (AOC-55), specifically documented by soil and groundwater sampling at former USTs (AOC-15b). The occurrence was slightly above applicable Standards and there is an absence of samples in the area that were analyzed for VO, therefore the horizontal extent of the suite has not been delineated.

7.2.3 BTEX VO Compounds

The VO compounds, and specifically benzene, toluene, ethylbenzene and xylenes (BTEX), have been associated collectively with petroleum products, although they are also separately used in the chemical industry. The site's post-1957 and current land uses involving the handling of crude petroleum and its refinement into a multitude of fuels, lubricants, and binding agents makes the Site a likely location for BTEX occurrences in the subsurface. In many instances the discovery of BTEX compounds has an origin in a TPH or EPH analysis, whereby elevated concentrations are detected which trigger the NJDEP required VO analysis. It is also acknowledged that TPHC or EPH concentrations can be attributed to historical fill material constituents such as coal, ash, and asphalt, however the associated contingency VO analyses do not often detect compounds due to their volatility and the age of the fill material contaminants.

Due to the site operations, the historical dataset documents numerous sampling points and the laboratory analysis of samples for TPHC, EPH, and/or VO compounds. The VO analyses have documented BTEX occurrences in the soil and groundwater at concentrations above applicable Standards and in particular areas of the Site. In general, the BTEX occurrences coincide with documented historic spill locations, former petroleum refining operations, consolidated refinery waste, and product storage.

7.2.3.1 Historic Spills

The designated Southern Remediation Management Unit (SRMU) encompasses a co-mingling of BTEX occurrences. The SRMU includes the 1991 Colonial Pipeline rupture (AOC-7), the former Smith Creek tidal channel (AOC-12), which received approximately 8 million gallons of product in 1969 from adjacent Tank 1214, the South Landfarm (AOC-2), the Rundown Tankfield (AOC-14b), and historic spills HS-6, HS-9, and HS-17. Product has been detected in the SRMU and removed from the soil and monitoring wells. A south-trending product occurrence has been documented, as well as a groundwater BTEX plume trending along Avenue B and the Colonial Pipeline.

The designated Tankfield Remediation Management Unit (TRMU) also encompasses a co-mingling of BTEX occurrences. The TRMU includes former Tank 1214 which ruptured in 1969, the Third Tankfield (AOC-54), and historic spills HS-2, HS-11 and HS-18. Product had been encountered during the removal of USTs (AOC-15a) within the TRMU. A comma-shaped groundwater BTEX plume within the TRMU has endpoints with AOC-15a and Tank 1214 and includes historic spills HS-11 and HS-18.

A BTEX occurrence is associated with the Truck Loading Rack Area (AOC-10) and Day Tankfield (AOC-57), located in the southern portion of the site. The area is the location of historic spills HS-8, HS-10, and HS-13. Product has been present in one monitoring well, TR-2R, which appears as the origin of a groundwater BTEX plume trending southward along the buried Smith Creek channel.

7.2.3.2 Former Refining Operations

A BTEX presence has been documented within the unsaturated soil beneath the former refining operation located east of the former Administration Building. No groundwater sampling has documented the extent of the soil contamination beneath this area.

7.2.3.3 Consolidated Refinery Waste

Soil sampling has identified TPHC and BTEX at the base of the North and South Landfarms (AOC-1 and AOC2, respectively). Quarterly groundwater monitoring data associated with these AOCs have identified BTEX in the vicinity of the SLF, although it is likely attributed to historic spills and not operations associated with the SLF. BTEX has also been detected in the groundwater around the NLF and adjacent Slop Gasoline Truck Unloading Area (AOC-46), although the source is not confirmed to be the NLF.

7.2.3.4 Product Storage

BTEX has been documented beneath the Second Reserve Tankfield (AOC-56). The origin and extent of the BTEX occurrence are unknown.

Sampling after the removal of USTs has documented product and BTEX occurrences. Groundwater BTEX impacts have been detected at AOC-15b, while product was visible in tank excavations north of the former Training Center (AOC-11b) and Administration Building (AOC-11a). The AOC-11a product location also coincides with the location of the TCA CVOC suite that was summarized in **Section 7.2.2**.

7.3 Groundwater Occurrence Summary

In conclusion, the site's sampling dataset documents site-wide and area-specific contaminant occurrences in the groundwater and their potential contaminant sources in the soil. Site-wide historic fill material is the likely origin for the metals, potentially the BN/PAH, and, to a lesser extent, the PCB impacts detected in the groundwater. The past and present petroleum-related activities are not likely to be the source for these detected contaminants.

The presence of CVOC contaminants appears associated with a historic pre-Hess on-site operation that was limited to one pre-existing building. That building, the former Hess Administration Building, is the location of the highest groundwater CVOC concentrations.

The presence of BTEX contamination is likely attributed to the past petroleum-related activities. The occurrences are associated with catastrophic, equipment-related, and corrosion-related petroleum releases and, to a lesser degree, the controlled placement of petroleum-containing waste

8.0 RECEPTOR EVALUATION

Pursuant to N.J.A.C. 7:1E-1.12 through 1.16 of the NJDEP *TRSR*, a Receptor Evaluation (RE) was prepared for the Site and will be submitted concurrently with this report.

8.1 Receptor Evaluation – Land Use

Land use within 200 feet of the property boundary includes residential homes. However, the closest residential property is over 800 feet from known petroleum impacts at the Site. In addition, all residences are considered to be topographically upgradient to the petroleum impacts. Multiple groundwater monitoring wells are located between the known impacts and the residences. These monitoring wells are sampled annually and there have been no contaminants identified in excess of the NJDEP GWQS.

8.2 Receptor Evaluation – Vapor Intrusion

An indoor air investigation was completed at the Former HC-PR Administration Building on November 10, 2010. All results were below the NJDEP Indoor Air Screening Levels. These 2010 analytical results, a Vapor Intrusion (VI) sampling form and spreadsheet, Full Laboratory Deliverables Form, and associated laboratory data were submitted to the NJDEP, USEPA, and Department of Health and Senior Services on February 28, 2011.

8.3 Receptor Evaluation - Ecological Receptors

Pursuant to Chapter 7:26E-1.16 of the NJDEP *TRSR* an Ecological Evaluation (EE) was conducted as part of the SI activities. An EE is a screening-level ecological risk assessment that serves to determine whether more rigorous ecological risk evaluations are warranted, and if so, to narrow the scope of subsequent activities. The EE completed for the HC-PR Site documents the following:

- Environmental Sensitive Natural Resources (ESNRs) are present on and adjacent to the site or are in locations receiving discharges from the site; and
- The HC-PR Site contains contaminants above Ecological Screening Criteria (ESC); and
- Potential contaminant migration pathways exist at the Site.

Since each of the conditions have been satisfied, an Ecological Risk Assessment (ERA) will be required pursuant to N.J.A.C. 7:26E-4.8. The ERA will determine whether actual or potential ecological risks exist at the site, identify those constituents that pose the adverse ecological risks, and generate data for risk-based remediation goal determinations and for any Risk Management Decisions (RMD).

9.0 CONCLUSIONS

Earth Systems, Inc. has prepared this *SIR* for the HC-PR Complex located at 750 Cliff Road, Port Reading (Woodbridge Township), Middlesex County, New Jersey.

A PA of the HC-PR Complex identified 117 potential AOCs. Of the total AOCs, the PA concluded that further investigation was warranted for 62 of the AOCs. A SI of these AOCs was performed and included the collection and analyses of soil and groundwater samples. The analytical findings and the locations of the collected samples have identified contaminant occurrences. The occurrences, supported by identified contaminant suites, are presented as follows:

- **Historic Fill Material**

There is a documented site-wide occurrence of elevated concentrations of metals, base neutrals, specifically the polynuclear aromatic hydrocarbon (PAH) subset, and to a lesser extent EPH, when the fractionated concentrations pass the EPH SRC Calculator. The elevated concentrations have been detected in the soil and groundwater. The site-wide occurrence suggests that the origins are not the targeted AOC, where the sample was collected, but the known presence of historic fill material that was introduced to the property for initial site development. The historic fill material has been documented by the NJDEP in its databases and in the soil boring logs that have been generated by the SI work. Continued delineation of the historic fill material contaminants is not planned for the Site, nor is it required.

- **Historic Product Releases**

There are localized occurrences of elevated concentrations of volatile organics and EPH, when the fractionated concentrations fail the EPH SRC Calculator. The elevated concentrations have been detected in the soil and groundwater. The localized occurrences and contaminants suggest indications of historic on-site releases of various raw and final products. Petroleum releases are suggested by the elevated benzene, toluene, ethylbenzene, and xylene (BTEX) occurrences, as well as the detection of LNAPL in both the soil and upon the water table. Chlorinated volatile organic compounds document a contaminant suite commonly associated with chemical solvents. Delineation of the identified occurrences will continue to identify their horizontal and vertical extent and, when delineated, for the planning of remedial strategies.

- **PCBs**

Isolated occurrences of PCB compounds have been documented by the soil investigation. No conclusion has been reached as to whether the occurrences are due to historic fill material introductions or whether the occurrences are due to on-site releases. Delineation of the identified occurrences will be completed to allow for the identification of their origin, determine their horizontal and vertical extent and, when delineated, for the possible planning of remedial strategies.